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FIELD SERVICE POCKET BOOK

UNITED STATES ARMY

1917

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

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WAR DEPARTMENT,
Document No. 605.
Office of The Adjutant General.

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PLATE I.

Scale of yards 1"=1 mile. R.F. $\frac{1}{63,360}$

1 2 3 4 5 6 7 8 9 10

Scale of yards 3"=1 mile. R.F. $\frac{1}{21,120}$

0 1000 2000 3000 35

Scale of yards 6"=1 mile. R.F. $\frac{1}{10,560}$

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Scale of strides (2 paces) 6"=1 mile.

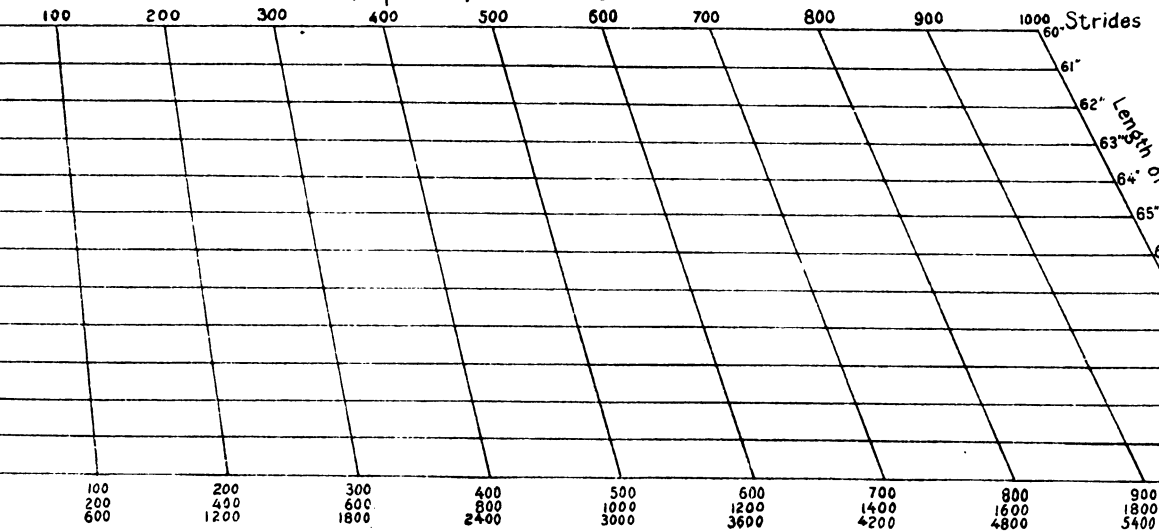

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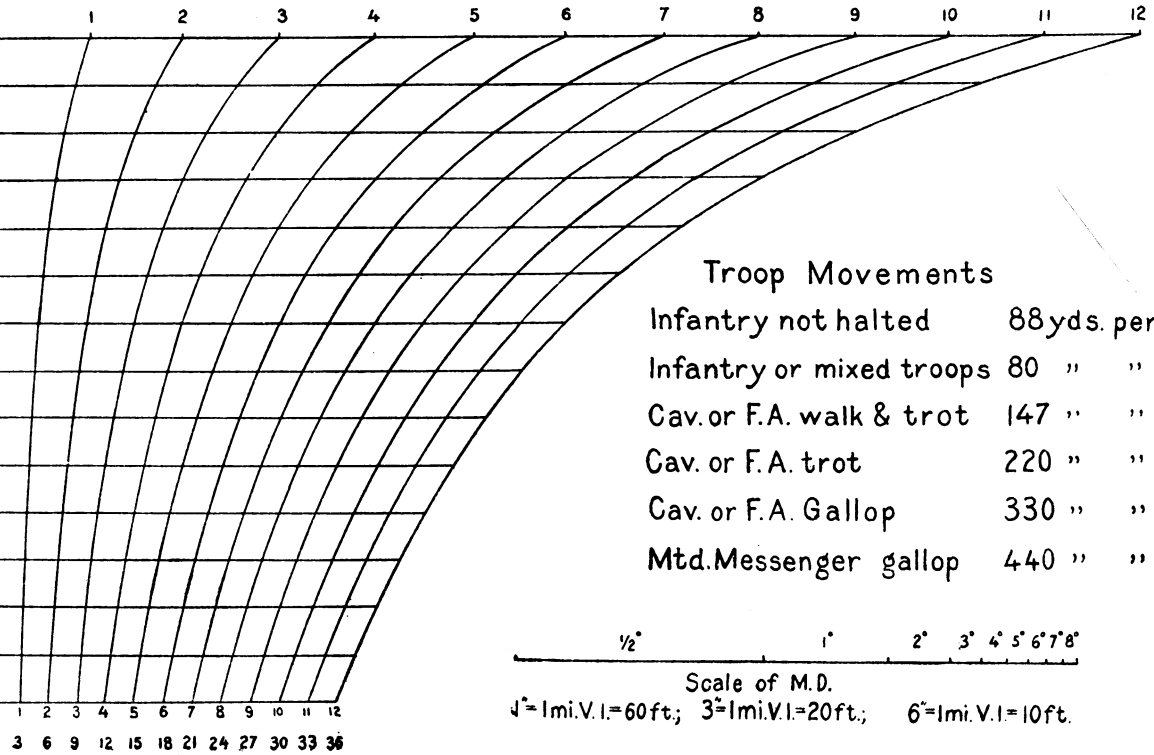
PLATE II.

Time Scale 3" 1 mile



Troop Movements

Infantry not halted	88 yds. per
Infantry or mixed troops	80 " "
Cav. or F.A. walk & trot	147 " "
Cav. or F.A. trot	220 " "
Cav. or F.A. Gallop	330 " "
Mtd. Messenger gallop	440 " "

Scale of M.D.

½"=1 mi. V.I.=60 ft.; 3"=1 mi. V.I.=20 ft.; 6"=1 mi. V.I.=10 ft.

(To face page 2.)

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WAR DEPARTMENT,
WASHINGTON, *May 28, 1917.*

The following Field Service Pocket Book is published as a supplement to the Field Service Regulations, for use in campaign, at maneuvers, and at tactical exercises. It is subject to frequent revision. It is not a textbook for the study of military subjects. It is merely a reference book, not to be quoted as authoritative. It should be amended by the possessor in accordance with changes in orders, regulations, and official publications and added to on the basis of experience.

[2608379, A. G. O.]

BY ORDER OF THE SECRETARY OF WAR:

TASKER H. BLISS,
Major General, Acting Chief of Staff.

OFFICIAL:
H. P. McCAIN,
The Adjutant General.

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ABBREVIATIONS.

(App. 9, F. S. R.)

A. G	Adjutant General.
A. R	Army Regulations.
A. T. S. R	Army Transport Service Regulations.
Cpl	Corporal.
Dist	District.
Dept	Department.
E. F. M	Engineer Field Manual.
F. S. R	Field Service Regulations, 1914.
G. C. M	General court-martial.
H. E	Horizontal equivalent; also, high explosive.
M. A. C	Manual for Army Cooks.
M. D	Map distance.
M. P	Military police.
Off	Officer.
Pvt	Private.
Q. M. C	Quartermaster Corps.
R. F	Representative fraction.
R. L. W	Rules of Land Warfare.
S. B	Signal Book.
S. Ct	Summary court-martial.
Sgt	Sergeant.
V. I	Vertical interval.

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DEFINITIONS.

Abatis: An obstacle formed of trees or branches picketed to the ground with their points toward the enemy.

Advance section: The area of the service of the line of communication within which are situated the advance depots of ammunition, supplies, animals, and material from which issues are made to divisional trains.

Alignment: A straight line upon which several elements are formed, or are to be formed; or the dressing of several elements on the same line.

Area: A portion of terrain assigned to a body of troops for a specific purpose.

Assembly: That arrangement of troops by which the units and individuals are formed in the normal order.

Balk: A road bearer in a military bridge.

Banquette: A bank or step upon which men stand to fire over a parapet.

Barrage: A zone of artillery, machine-gun, or trench-weapon fire established for the purpose of preventing the passage of troops; also called *curtain fire.*

Base: The element on which a movement is regulated or formation made, or a place where the line of communications originates, where supplies of all kinds for the forces in the field are kept, and where the business of supplying these forces is located and organized under the military authorities.

Battle sight: The position of the rear sight on the service rifle when the leaf is laid down. This corresponds to a range of 547 yards.

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Bay: The distance bridged by one set of balks.

Berm: A small bench of earth left between the parapet and the excavation of a trench.

Billets: Shelter in public or private buildings.

Bivouac: An encampment without shelter, except improvised.

Bomb-proof: A shelter, proof against penetration by shells.

Caliber: The diameter of the bore of a gun in inches, measured across the lands.

Camouflage: Concealment by artificial means, as by painted scenery, etc.

Camp: An encampment under canvas.

Cantonment: Shelter in huts or temporary buildings.

Column: A formation in which the elements are placed one behind another.

Command: Vertical height of the crest of a parapet above the natural surface of the ground.

Cossack post: An observation post consisting of four men, employing a single sentinel.

Cover: Protection from fire or view.

Covering detachment: Troops screening others from attack or observation.

Crest: The summit of a ridge or hill; or the intersection of the slopes of a parapet.

Crest, military: The line nearest a crest from which all the ground toward the enemy may be seen and reached by fire.

Danger space: The distance, in the plane of the slope considered, over which an object of a given height would be pierced by a given trajectory.

Dead-ground: Ground which is not covered by fire.

Defile: A portion of a route which troops can only traverse on a narrow front (a mountain pass, a bridge, an embankment, etc.).

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Deployment: An evolution by which a command extends its front; it may be partial, as when heads of columns form on the same line; or complete, as when a firing line is formed, with supports and reserves.

Depth: The space from head to rear of any formation, including the leading and rear elements.

Development: Those evolutions by means of which columns of troops, advancing to the attack, break into smaller columns to facilitate deployment.

Disposition: The arrangement of elements in a formation.

Distance: The space between elements in the direction of depth; it is usually measured from the tail of one element to the head of the element following it.

Distributing point or station: Place where the field or combat trains are refilled by the supply or ammunition trains.

Dress: The act of taking a correct alignment.

Drill: Exercises and evolutions taught and executed in accordance with definitely prescribed methods.

Echelon: A body of troops is "in echelon" with reference to another body when it is more or less advanced and unmasks or uncovers the same, wholly or in part. Units so placed are called *echelons*. Sometimes used to designate the different elements of a tactical command.

Element: One of the component parts of a larger unit, as a file, squad, platoon, company, team, carriage, wagon, truck, etc.

Epaulment: A small parapet to give cover to a gun and its detachment in action.

Evolution: A movement by which a command changes its position or passes from one formation to another.

Fascine: A long bundle of brushwood used for revetting.

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File: Two men, the front rank man and the corresponding man in the rear rank. The front rank man is the *file leader*. A file without a rear rank man is a *blank file*. The term *file* applies also to individual men in single rank formation and to a single mounted man in ranks.

Fire, curved: Fire with low muzzle velocity, the elevation not exceeding 540 mils.

Fire, direct: Fire with high muzzle velocity, the elevation not exceeding 360 mils; or, delivered by a gun laid by using gun sights directed on target.

Fire, enfilade: Parallel to the hostile line.

Fire, flank: Parallel to the defender's line and delivered by him.

Fire, frontal: Perpendicular to the front of the target.

Fire, high angle: With an elevation exceeding 540 mils.

Fire, indirect: Delivered by a gun laid for direction on an aiming point other than the target.

Fire, oblique: Inclined to the front of the target.

Fire, oblique reverse: Inclined to the front of the target and coming from the rear.

Fire, plunging: Delivered from a point higher than the target.

Fire, reverse: Coming from the rear.

Fire direction: The tactical direction of one or more fire units with a view of bringing their fire to bear at the right place at the right time.

Fire discipline: That condition resulting from training and practice which insures an orderly and efficient working of the personnel in the delivery of fire.

Flank: The right or left of a command in line or column. By the enemy's *right* (*left*) *flank* is meant the flank which the enemy himself would so designate.

Foragers: Mounted troops in line in extended order.

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Formation: Arrangement of the elements of a command in their order in line, in column, in echelon, or in battle.

Fougasse: A small ground mine filled with stones which are projected toward the enemy when the mine is fired.

Front: The space in width occupied by an element, either in line or column. The term front also designates the direction of the enemy.

Gabion: An open cylinder of brushwood, sheet iron, etc., used in revetting.

Gait: The rate of movement of a mounted command.

Glacis: The ground in front of a trench within close rifle range.

Gradient: A slope expressed by a fraction; 1/30 represents a rise or fall of 1 foot in 30 feet.

Guide: An officer, noncommissioned officer, or private upon whom the command or an element thereof regulates its march.

Head: The leading element of a column.

Header: Sods, sandbags, etc., placed so that the longest side is perpendicular to the face of the structure.

Information officer: An officer sent by the commander of a unit to the headquarters of the next higher command or of a neighboring command for the purpose of keeping in touch with and sending back prompt information of changes in the tactical situation.

Interval: Space measured between elements of the same line.

Laying: The process of pointing for range and direction so as to cause the trajectory to pass through the target.

Laying, direct: Pointing for direction and elevation by directing the line of sight upon the target.

Laying, indirect: Pointing for direction by directing the line of sight upon an aiming point other than the target, the elevation being obtained by the use of a quadrant or elevation level.

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Leading troops: Troops leading the way for others; most common in application to a retirement.

Left: The left-hand extremity or element of a body of troops.

Line: A formation in which the different elements are abreast of each other; when the elements are in column, abreast of each other or on the same general line, the formation is called a *line of columns.*

Line of communications: The system of communication by rail, road, and navigable waterways between the army and its base, together with the district through which they pass, within the limits prescribed by the commander in chief.

Line of communication troops: That portion of the field army which is detailed for the service of the line of communications.

Maneuver: A movement by which a tactical unit changes from one formation to another.

Maneuvers: Operations against an outlined or represented enemy.

Map maneuver: A tactical or strategic exercise conducted on a map.

Markers: Individuals placed to mark the route.

Mil: A unit of angular measure (1/6400 part of a circle). The arc which subtends a mil at the center of a circle is, for practical purposes, equal to 1/1000 of the radius. Hence, at 1,000 yards, 1 mil subtends 1 yard; at 2,000 yards, 2 yards; etc. One degree equals $17\frac{7}{9}$ mils.

Mobilization: The process by which an armed force passes from a peace to a war footing.

Order: An indication of the will of a commander in whatever form conveyed.

Order, close: The formation in which the elements are arranged in line or column with normal intervals and distances.

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Order, extended: The formation in which the elements are separated by intervals or distances greater than in close order.

Orient: To inform one of the tactical situation; or, in map reading, to determine the points of the compass.

Outguard: A small detachment of an outpost nearest the enemy; it includes pickets, sentry squads, and cossack posts.

Outpost cavalry: Cavalry attached to an outpost.

Pace: The denomination of the different rates of speed; usually used in referring to dismounted troops. Also the length of step (30 inches in quick time).

Parados: A parapet to give cover from reverse fire.

Patrol: A group of men detached from a command and operating with a specific mission, usually related to security or information.

Patrol, combat: One whose mission is to offer resistance by either offensive or defensive action, usually to guard a flank.

Patrol, officer's: One commanded by an officer.

Patrol, strategic: One whose duty is to obtain strategic information.

Patrol, tactical: One whose duty is to obtain tactical information.

Picket: A group consisting of two or more squads, posted in the line of outposts to cover a given sector.

Ployment: An evolution by which a command diminishes its front.

Profile: The section of a trench perpendicular to the crest.

Railhead: A locality on the railroad where ammunition and supplies are transferred to ammunition and supply columns or trains.

Rally: The rapid grouping behind a leader of the various elements of a command without reference to their previous situation or formation.

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Rank: A line of elements abreast of each other in close order.

Reconnaissance: Search for information of the enemy or of the terrain.

Reference point: An object within view, used as the origin of measurements or directions.

Refilling point: Place where division ammunition or supply trains are refilled by the line of communications.

Relief: The height of the interior crest of a parapet above the bottom of the trench; or, the length of time that men have to work before being relieved; or, a number of men who work or are on duty for a given length of time.

Rendezvous: Place to which the columns of the line of communication are sent where they are met by agents of the trains and conducted to refilling points.

Revetment: Any material formed into a retaining wall to support earth at a steeper slope than the natural one.

Right: The right hand extremity or element of a body of troops.

Saddle: A depression between two adjacent hills, or a low place in a ridge.

Salvo: A single discharge from each of the guns of a unit fired in regular order from one flank to the other.

Sap: A trench formed by constantly extending the end toward the enemy.

Scout: An individual detached from a command and operating with a specific mission, usually related to security or information.

Sector: A portion of terrain limited by designated lines perpendicular or inclined to the front.

Sentry squad: A squad posted in observation, or to guard some special object.

Sketch, outpost: A map made by an observer confined to a particular line.

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Sketch, panoramic: A perspective sketch made from a fixed point.

Sketch, place: A map made by an observer confined to a particular point.

Sketch, position: A map made by an observer free to traverse the ground sketched.

Sketch, road: A map of a road showing its features and at least 300 yards of the terrain on each side.

Skirmishers: Dismounted men in line with extended intervals.

Slope, interior: The inside slope of a trench extending from the crest to the banquette.

Slope, reverse: A slope that, from the direction of the enemy, is hidden by the ridge of which the slope is a part.

Slope, superior: The top of the parapet immediately forward from the crest.

Span: The horizontal distance between the centers of any two supports of a bridge.

Splinter-proof: A shelter proof against splinters of shell and shrapnel bullets.

Stretchers: Sods, sandbags, etc., placed so that their longest side is parallel to the face of the structure.

Stride: Two natural steps or paces.

Successive formation: A formation in which the elements take their places in regular order, one after the other.

Tactical exercise: An operation against an imaginary, outlined, or represented enemy whose movements are restricted with a view of illustrating some particular tactical principle.

Tactical walk or ride: A tactical exercise carried out on the terrain, the troops being imaginary.

Tail: The rear element of any unit or column on the march.

Task: The amount of work to be executed by a man or group during a relief.

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Theater of operations: The whole area of land or sea in which fighting may be expected or in which movements of troops are liable to interference by the enemy.

Trace: The horizontal projection of the interior crest of a work or trench.

Train, combat: Transportation accompanying organizations, carrying ammunition, tools, etc.

Train, field: Transportation allotted to units for conveyance of the baggage, stores, and food supplies.

Traverse: A bank of earth to give cover from oblique and enfilade fire.

Volley: (Art.) The rapid discharge of a certain indicated number of rounds, by each gun of a unit, each gun firing without regard to the others. (Inf.) The simultaneous discharge of all the rifles of a unit at command.

Zone: A portion of terrain limited by lines generally parallel to the front.

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1. General Organization and Functions of the Staff.

COMMANDING GENERAL

CHIEF OF STAFF

Primarily charged with responsibility for the efficiency of the General Staff service, exercising under the Commanding General such supervisory and coordinating power over the remainder of the command, including administrative service, as will enable operations to be undertaken with confidence in the efficiency of all parts of the command.

RECORD, PERSONNEL, A

(Adjutan

The Adjutant as the medium of communication between th
except the General Staff is the head of the technical and a
custody of all records of the Headquarters except the con
General Staff, and administrative records pertaining to mor
istrative and routine orders, circulars, memoranda, etc., a
present when operation orders are decided upon and pre
staff service. His office keeps rosters; prepares, enters, a
authority; conducts routine business of the command, etc.

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ived of the enemy, disposition, move-

rmation of the theater of operations.

ents, and wireless interceptions.

t.

tants of occupied territory.

t the command.

, photographers, and other civilians in

legraph, etc.

SUPPLY

(Quartermaster)

Transportation of personnel and supplies.
Supply of transportation, repairs, etc.
Clothing.
Quartermaster equipment.
Subsistence.
Fuel.
Lights.
Water.
Camp sites.
Quarters and offices.
Pay of personnel, and general disbursements.
Laundries and baths.
Remounts.
Claims.
Salvage.
Workshops.
Cemeteries.
Policing battle fields.
Burials.
Labor.
Etc.

INSPECTION

(Inspector)

Investigations as required.
Inspections of all classes, except tactical, including organizations, camps, quarters, interior economy; transportation, morale, messing.
Condemnation of property.
Verification of money accounts.
Etc., etc., etc.

LAW

(Judge Advocate)

Preparation and investigation of court-martial charges.
Examination and tentative review of court-martial cases requiring action of commander.
Court-martial orders.
Supervision of administration of military law.
Submission of legal opinions on request.
Etc.

SANITA

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CHAPTER I.

ORGANIZATION.

It is not considered advisable at the present time to include in a general publication of this nature the new organization of the Army. Accordingly, the Organization Tables originally intended to constitute the principal part of this chapter have been omitted. Those in force at the time the book was first prepared are now obsolete. The present tables will be furnished to those whose duties require a knowledge of the organization of the Army.

(Pars. 357–385, F. S. R.)

2. Steps to be taken preliminary to the establishment of a line of communication are:

(1) The location of storehouses, yards, shops, and their immediate construction, with special facilities for explosives.

(2) The location of hospital facilities and preparation for their use.

(3) The location of camps and their preparation, including roads, water supply, drainage, etc., for organizations, casuals, and prisoners.

(4) Taking over and preparing for operation the railway and terminal facilities.

(5) The establishment of an employment bureau and a military police and secret service bureau.

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(6) The taking over of the water supply, telephone, and electric lighting systems, wireless stations, and other public utilities.

(7) The establishment of a bureau of information.

(8) Inventory of supplies locally available.

(9) Plan for military government, and control of all government bureaus.

(10) Plans for unloading troops, animals, supplies, etc., and for their disposal until the move to the front.

(11) Taking the census.

(12) If base is a seaport, application for a Navy officer as captain of the port.

(13) Determination of amount of civil traffic that will be necessary on railways.

3. The approximate tonnage that will have to be supplied to troops by the line of communications is 50 pounds per man per day.

4. There are four units that account for most of the items of supply, viz., a man, an animal, a vehicle, and a field gun. In a well-balanced army these items can be reduced to the single unit of the number of pounds per man per day. This amount of 50 pounds per man per day is what is to be provided for under normal conditions. If unusual military activity is to be expected, the facilities for the prompt forwarding of ammunition of all kinds must be capable of rapid expansion, and the above estimate may be greatly exceeded.

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CHAPTER II.

MARCHES AND MARCH DISCIPLINE.

(Pars. 96–114, F. S. R.)

GENERAL PRINCIPLES.

5. The rate of marching throughout a column should be uniform. An irregular pace is most exhausting, especially to troops at the rear of the column.

No bugle calls are allowed on the march in the presence of the enemy, and on field service no compliments are paid.

6. When not in the presence of the enemy, the order of march of the main body will depend chiefly on the comfort of the troops, which in its turn depends largely upon the convenience of supply. When in the presence of the enemy, units will usually march in the order in which they would come into action. Artillery must be preceded by sufficient infantry to afford it protection.

7. All vehicles should march on the right of the road, and when a halt is ordered each vehicle should be drawn up at once on that side of the road. Cross roads should be left clear. The regulation distances between vehicles should be preserved, and no one, other than the driver, should be allowed to ride on any vehicle without a written order.

8. All sutlers, civilians, etc., who may accompany troops or their transport on the march, must be made to observe the regulations prescribed for infantry.

9. For fordable depths see app. 7, F. S. R., 1914. For discussion of fords, see par. 390.

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MARCHING IN FROST AND SNOW.

10. *Cold.*—The most efficacious measure against cold is an increased issue of rations; during halts the men should not be allowed to sit down or to fall asleep. It is best not to make long halts. In the cavalry, men should dismount from time to time and lead.

11. *Frostbite.* See pars. 651, 668–672.

(*a*) Keep the feet clean, as dirty feet are more liable to perspire and are consequently more sensitive to cold.

(*b*) Wash the feet with soap and then smear them over with some greasy substance, such as unsalted grease, kerosene, etc.

(*c*) Wear stout, roomy shoes and woolen socks or foot cloths, or the feet may be wrapped in a double set of linen foot cloths, the under pair being greased.

To protect the hands and face, smear them with one of the greasy substances referred to above, wear mits or woolen gloves and ear flaps. Men should be instructed as soon as they feel frostbite anywhere, to rub the part with snow at once until the color returns, but on no account to warm it near a fire.

12. *Snow blindness.*—To prevent snow blindness wear colored glasses; failing these, a mask with very small holes for the eyes gives fair protection.

The cheeks and sides of the nose greased and covered with powdered charcoal also relieves the eyes.

13. *Face blister.*—The prevention for this is a mask of some sort.

14. *Miscellaneous.*—To prevent *wet boots* from shrinking fill them with oats overnight; the oats will swell and keep the boots from shrinking.

If you have difficulty in pulling on a wet boot, light a piece of paper, drop it into the boot, and let it burn itself out. It

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will not hurt the wet boot, but will cause a film of steam inside, which will act as a lubricant.

GENERAL RULES FOR NIGHT MARCHES.

15. Local guides should be secured. Outposts should not be withdrawn until the last moment.

The march should generally be protected by small advance and rear guards, usually composed of infantry only; flanks are best protected by patrols from the advance guard. The distance of these bodies from the column should be small.

All ranks must know what to do in case of a surprise attack or other alarm.

Every commander must have a fixed place in the column.

Regulation distances between units should be reduced or omitted; an officer should invariably march in rear of each unit.

Men should be posted at crossroads to prevent troops going astray.

Rifles should not be loaded, but magazines should be.

Hours and periods of halts should be arranged beforehand; men may lie down but must not leave the ranks during a halt.

16. *To silence the noises made by harness and vehicles at night*, rattling and rubbing parts should be bound with strips of canvas and secured by stitching; bits and their parts with cloth, cord, or twine; swingletrees and pole with sacking; lunette, with sacking, leather, or rubber; drag washers should be tied to a spoke or fitted with additional washers to a working fit. Wheels may be covered with motor tires, leather belting 6 to 7 inches wide, laid along the tire and tied across the felloes, or straw, hay, or rope binding.

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CARE OF THE FEET.

17. The real causes of sore feet are ill-fitting shoes and socks, combined with uncleanliness.

The feet should be washed at least once a day, and if this is impossible they should be wiped over with a damp cloth, especially about the toes.

Excessive sweating may be relieved by bathing in water colored a bright pink with permanganate of potash. Socks when taken off should be stretched, well shaken, and placed on the opposite feet when next worn. Where the socks fit over tender parts of the feet they should be greased inside.

Blisters should be pricked at opposite sides near the sound skin with a clean needle and all tender parts smeared with some simple ointment or with soap. A good ointment is one of vaseline with 2 per cent of salicylic acid added, and various powders are in use for the same purpose. If the shoes are large enough, the wearing of two pairs of socks will prevent abrasions on the feet even when wet.

CARE OF HORSES.

18. Nothing should be carried beyond the authorized articles.

Rise in the stirrups, do not lean on rifle (if carried), see that the load is evenly distributed on both sides of the saddle. If possible, at some halts, remove the saddles or loosen the girths and shift the saddles. When saddles are removed slap the backs to promote circulation, and allow the horses to roll.

On a night march, when hard work is expected, halt, water, and feed an hour before dawn.

WATERING.

19. Take every opportunity of watering on the march. Always water before feeding, never immediately after. Good

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common sense and previous careful reconnaissance of watering places will prevent unnecessary delay and insure that animals get enough water.

If practicable, dismount, remove bits, and loosen girths before watering.

Some horses can not drink with two bits in the mouth.

Do not allow horses to go farther into a pool to drink than is necessary, or the water will be fouled for those coming after.

Do not move at a fast pace immediately after watering. Select watering place with sound bottom, good approach, and water at least 4 inches deep. Running water with gravelly bottom is the best. Avoid dark colored water.

Animals do not drink well in the early morning, when an early start has been made. All animals should be watered after from 1 to 3 hours' march.

FEEDING.

20. Give a small feed before a long march, however early the start may be.

Feed en route during marches of over five hours' duration. Remember that horses require a considerable time to consume their rations; not less than 5 hours in 24 should be allowed. This includes the consumption of both hay and grain.

Remove nosebag when horse has finished and let him graze if possible.

21. The difference in size of horses and mules, the great variation in amount of food available on any piece of ground used for grazing, and other factors make a positive statement impossible, but it may be taken as a general rule that with fair to good grazing a horse or mule will fill his belly in about an

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hour. To insure that the horse or mule receives the full value of his food his belly should be filled three times daily—that is, it takes the equal of three stomachfuls to furnish the horse or mule enough subsistence for his needs. As a rule horses will not graze if thirsty.

22. When horses are particularly hungry it is best to feed a small amount of hay before the grain is fed. This serves to take the edge off the appetite and the horse will not be so likely to bolt his grain.

TIME AND SPACE.

23. In moving to a starting point it may be taken that all troops march at a rate of 88 yards a minute.

24. Rates of movement in the field are approximately as follows:

Arm.	Miles per hour.		Miles per day.	
	At drill.	On the march with halts.	Ordinary march.	Forced march.
Infantry, or mixed troops	3	2½–2¾	12–16	16–30
Cavalry			20–25	25–50
At a walk	4	3¼–3½		
At a trot	8			
At a gallop	12			
Alternating walk and trot		5		
Wagons		2–2½	12–20	
Motor trucks		6–10	40–60	

25. Empty wagons on good roads can make longer marches.

26. In calculating road spaces in tables given below, it is assumed that infantry marches in column of squads; cavalry

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and other mounted detachments, in column of fours; artillery, in section column; vehicles, in single file.

27. The drill regulations of the several arms regulate the distance between elements; the distance between units is taken as 50 yards.

The minimum distance between motor trucks in a convoy is 15 yards, but when proceeding up and down hills the distances should not be less than 40 yards.

In calculating the road space occupied by a motor truck convoy moving at full speed, 100 yards per vehicle should be allowed.

28. Road Space Tables.

Arm.	Yards.	Yards + C. tn.	Yards + F. tn.
Infantry:			
Company	51	.....	.....
Battalion	232	268	.....
Machine gun co	120	144	.....
Regiment	879	1,011	1,203
Brigade	2,712	3,108	3,708
Cavalry:			
Troop	132	.....	.....
Squadron	580	604	688
Regiment	2,134	2,280	2,478
Brigade	6,452	6,740	7,784
Field artillery:			
Battery	273	465	.....
Battalion	626	1,010	1,122
Regiment	2,081	3,253	3,589
Brigade	6,425	9,941	10,977
Field artillery, mountain:			
Battery	183	287	331
Battalion	629	809	1,085
Regiment	1,373	1,880	2,362
Engineers:			
Company	112	136	160
Battalion	361	445	517
Regiment	816	1,008	1,140

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28. ROAD SPACE TABLES—Continued.

Arm.	Yards.	Yards + C. tn.	Yards + F. tn.
Mounted engineers:			
Company	140	152	.....
Battalion	460	520	604
Field bn. sig	276	372	450
Aero squadron	.....	.....	500
Trains:			
Military police	.....	.....	375
Supply—			
6 motor truck cos	.....	.....	1,539
Wagon train	.....	.....	3,196
S. A. ammunition, motor	.....	.....	1,595
Art. ammunition, motor	.....	.....	1,628
Hdqrs. am. tn	.....	.....	31
Ammunition tn. wagon—			
Small arms	.....	.....	2,004
Artillery	.....	.....	2,094
Engineer tn	.....	.....	1,500
Sanitary	.....	.....	1,100
2 field hosp. motor trucks	.....	.....	180
2 field hosp. wagons	.....	.....	220
Headquarters	.....	.....	30
Total F. H. (½ motor, ½ wag.)	.....	.....	430
2 motor amb. cos., each	.....	.....	124
2 wagon amb. cos., each	.....	.....	200
Hdqrs	.....	.....	30
Total amb. cos. (½ each M. and W.)	.....	.....	680
4 camp infirmaries	.....	.....	50
Division	20,348	21,932	[1] 25,100
Div. tns., wagon	.....	.....	[2] 9,400
Div. tns., motor T	.....	.....	[3] 7,700

[1] 14.2 miles. [2] 5.4 miles. [3] 4.4 miles.

SHELTER.

(Pars. 232–246, F. S. R.)

29. In the field, troops may be disposed—

In bivouac.

In camp.

In cantonments.

In billet, when authorized.

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30. Troops should not be bivouacked except for cogent reasons. A comfortable camp on a sanitary site is always desirable, provided tactical requirements permit the selection.

31. Troops should not be kept in column at the end of a day's march, but should be placed in camp immediately upon their arrival. Halt orders should be issued well in advance. A staff officer, accompanied by a surgeon, should be sent ahead to make the necessary preliminary arrangements and be ready to assign organizations to their camps upon arrival.

BILLETING.

31. The health and efficiency of troops are often best conserved by utilizing buildings for shelter, especially in cold and inclement weather. When tactical consideration permits, and when authorized, troops may be billeted. Public buildings, warehouses, etc., if available are to be preferred to private residences.

33. In the field, two classes of quarters are recognized, *ordinary quarters* and *close quarters.*

34. *Ordinary quarters* are occupied only at such distance from the enemy as admits of the comfort of the troops and animals being the first consideration. There may be no objection to a mingling of the different arms for the fuller utilization of stabling, and dispersion, either longitudinal or lateral, is limited only by the time and fatigue involved in having the troops assemble should tactical considerations require it.

35. *Close quarters* are used when large bodies of troops are making long marches, when it is not desirable to fatigue the men by sending them long distances from the road, or when in close contact with the enemy. Every building is packed with

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as many men and animals as it will hold, and the remainder bivouac in the immediate vicinity, but never in the streets. Tactical considerations govern. There should be no mingling of the different arms. If an engagement is imminent, the larger units should be distributed from front to rear in the order in which they will come into action, infantry occupying the more exposed positions, cavalry and other mounted troops the less exposed, and artillery, medical units, and trains always covered by other arms.

36. *General rules.*—The following rules must be observed in distributing troops:

(*a*) Depots should be near good roads.

(*b*) Dismounted troops should be nearest the water supply.

(*c*) Hospitals and staff have the first claim on quarters.

(*d*) When quarters are limited, cavalry and other mounted troops have precedence over dismounted troops.

(*e*) Hospitals should be given a quiet spot and the most sanitary position.

(*f*) Staff and telegraph offices should adjoin, if possible, and should be clearly marked.

(*g*) Officers must be close to their men, and units kept together.

(*h*) When a column is halted for the night only, the troops composing it should not be quartered more than a mile or two from the next day's route of march.

37. *Allotment of quarters.*—The chief of staff allots *billeting areas* to corps and divisions. Division chiefs of staff allot areas to brigades and smaller units, and the quartering of troops within the allotted areas is supervised by staff officers assigned to that duty. The senior staff officer within each area so assigned will, if practicable, issue requisitions for the

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necessary quarters in the name of the superior commander, describing the area within which quarters are to be furnished, and stating the number of officers, enlisted men, and animals to be quartered. The requisition will also state whether food and forage will or will not be provided. The number of days quarters will be required will be stated only by specific order of the superior commander.

38. In estimating the capacity of areas for the quartering of troops, the following rules will serve as an approximation:

(*a*) A given area will house and feed for one week a force equal to twice the population.

(*b*) Quarters without subsistence may be estimated at about 10 men per inhabitant in rich farming country, and at the rate of 5 or 6 per inhabitant in towns and villages.

BILLETING PARTIES.

39. The regimental billeting party serves as a type of those of other units, should others be desirable. It is ordinarily composed of one regimental staff officer and one noncommissioned officer of the regimental noncommissioned staff, with two enlisted men of each company. The officer should be provided with the requisition described above, and with information as to the locality and extent of accommodations. On arrival at the prescribed locality he will proceed direct to the proper official (mayor, president, chief of police, owner, etc.), and present the requisition for quarters. He will also inform this person of the time troops will arrive, and of any special rules that the inhabitants will be required to observe, and will ask information as to any infectious diseases, the character of the water supply, etc.

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40. If time permits, the local authority will prepare an order for presentation by the billeting party to each inhabitant on whom men and horses are to be quartered. This order should state the number of officers, men, and horses to be accommodated by the inhabitant, and whether food and forage are or are not to be provided by him.

41. On receipt of these assignments the officer will distribute them in proper proportion to the representative of each company, and will give him any necessary instructions regarding the posting of warnings on infected buildings, arrangements for watering, special guards necessary, location of headquarters, and the place and time of assembly when the quarters have been inspected. The men of the company will then proceed to the houses and stables allotted to their organization, to the occupant of each of which they will present their order, and proceed to inspect each building, marking clearly with chalk on the door of each, the names of officers and number of men and animals it is to accommodate, together with the command (commanding officer and regiment), to which they belong. *These marks will be erased before vacating the quarters.*

In the meantime, the officer will select and mark the position of the regimental headquarters, guardroom, stables for headquarters animals, etc., and select the locality for gun and train parks. He will ascertain the most suitable line for communicating with neighboring units, and will, if practicable, prepare for the information of the regimental commander a sketch showing the assignment of the various units, giving details regarding roads and communications. On reassembling his men, he will point out the location to them and direct them to convey the information to their organizations and guide them to their quarters.

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42. When time is not available for the above procedure, the troops will be halted outside their assigned areas. A party from each brigade will present to the mayor or other official a requisition for quarters, and request his cooperation in the allotment of the same. He will take steps to notify the inhabitants as to what is required. At the same time the billeting party will roughly allot the accommodations, areas being assigned to the larger units, and these in turn allotting certain streets or houses to their units.

43. In alloting quarters, the following points should be observed, in addition to those noted above:

(*a*) Regard should be paid both to the comfort of the men and the interest of the inhabitants.

(*b*) Staff officers should be on main communications and easily found.

(*c*) Mounted men should be near their horses, guns, and wagons.

(*d*) Both sides of a street should be allotted to the same unit.

(*e*) Roads and communications must never be blocked.

GENERAL RULES IN QUARTERS.

44. (*a*) Officers will visit the quarters of their men and horses' stables at irregular intervals, at least once during each day and once each night.

(*b*) If necessary, the inhabitants should be disarmed and allowed to leave their quarters only during prescribed hours, the streets being patrolled to insure obedience to this order. When out after dark, they should be required to carry lights.

(*c*) From the moment the advanced billeting party enters a town, village, or farm, precautions must be taken to prevent the

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inhabitants conveying information to the enemy. Telephones and telegraph must be seized.

(*d*) All houses where liquor is obtainable must be placed under control. In every house occupied by troops one man, at least, must be constantly on guard over the arms, which must never be left stacked outside. As a precaution, both against fire and possible signaling to the enemy, directions should be issued controlling the use of fire and lights, both by the inhabitants and the troops.

(*e*) When the enemy is within striking distance the villages in the front line should be prepared for defense against surprise, and a portion of the troops in them kept in constant readiness, so that the defenses may be rapidly occupied.

(*f*) An *alarm signal* and places of assembly should be designated and troops should be exercised in turning out. This exercise is specially important at night.

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45. Assembly Formations, Assembly Spaces, Contracted Camps, and Semipermanent Camps for a Division and its Elements.

STRENGTH BASED ON THE ACT OF JUNE 3, 1916.

Units.	Assembly formation.	Assembly space.		Contracted camp.		Semipermanent camps.	
		Yards.	Acres.	Yards.	Acres.	Yards.	Acres.
Inf. regt	Line of masses	253 x 85	4.5	250 x 175	9	300 x 360	22
Cav. regt	do	152 x 72	2.5	250 x 200	10¼	310 x 340	26
F. A. regt., light	Line of double sec. cols., closed intervals.	205 x 200	8.2	240 x 300	17.7	290 x 435	26
Engineer regt	Line of masses	132 x 70	2	250 x 80	4.1	270 x 375	18
Field bn. sig	Line sec. cols	25 x 100	.5	200 x 50	2	80 x 310	5
Aero squadron	do	25 x 100	.5	350 x 225	16	225 x 350	16
Tn. and mil. police				265 x 25	1.5	80 x 320	
Am. Tn.:							
S. A. sec				380 x 80	6.2	320 x 170	11.5
Art. sec				380 x 80	6.2	320 x 170	11.5
Supply train				380 x 80	6.2	190 x 320	13
Engineer train				200 x 90	3.75	85 x 280	5
Sanitary train				270 x 115	6.5		18
4 amb. cos						180 x 300	11
4 F. H. and 4 C. I. (1 F. H. established).						120 x 280	7
Inf. brigade	Cols. regts. in line of masses.	253 x 355	18.5	315 x 460	30	380 x 950	74
Art. brigade	Cols. regts. each in line, double sec. cols. at closed intervals.	205 x 610	25.5	300 x 770	47	455 x 920	85
Division (with tns.)			110		210	1,425 x 1.815	528
C. tns. (excluding art.)	Line sec. cols. at 3 yds. int.		.2				
F. tns	do		4				
Div. tns	do		12				

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SANITATION.

46. Neglect of sanitary measures results in disease, followed by loss of life. This may paralyze the efficiency of the force.

47. Every commander is responsible for the sanitary condition of the quarters or localities occupied by his command.

48. Every person in the command is responsible for the cleanliness of his immediate surroundings and of his own person.

49. The medical officer attached to a unit is the adviser of the commander in sanitary matters. He must make frequent inspections, and not be sparing of his advice.

50. It is the duty of every officer and man to keep himself clean, healthy, and fit for duty at all times.

51. In barracks, camp, bivouac, on the march, or in the trenches utmost care must be taken to prevent fouling of the ground by excreta or refuse. Urinals and latrines should be made immediately on arriving at camp or bivouac, and should be filled in at the last possible moment before leaving.

52. Kitchen slop water must not be thrown about. It should be disposed of in pits, and all solid kitchen refuse burned.

53. Food must be protected from dust and flies. Horse dung, stable litter, fragments of food, and other refuse form breeding places for flies.

54. Refuse of all descriptions should be burned daily. What can not be burned must be buried.

55. Any fouling of camp or trenches must be severely dealt with.

56. Empty tin cans and other refuse must be collected in receptacles kept for that purpose and buried in a refuse pit.

57. When troops occupy trenches, latrines will be constructed in trenches leading from the communicating trench.

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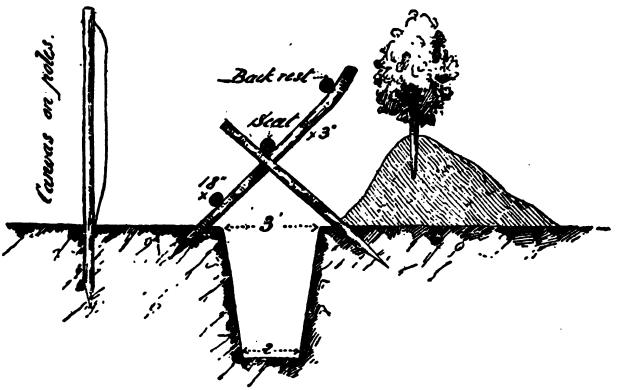
When the trenches are to be occupied for more than two days the bucket system must be used, buckets emptied at least daily, and chlorid of lime or creosol used freely. Buckets should be emptied at night, and soil buried in a deep pit well away from



the trenches. Other refuse will be thrown into these pits also, and the entire mass burned as far as possible. When nearly filled with refuse or excreta to within not less than 2 feet of the surface the pits will be filled up and placarded.

58. Latrines must be placed as far as possible from kitchens and from source of water supply and to the leeward if possible. They must not be placed in gullies which drain into the water supply.

59. Every man must be required to cover his excreta with earth.

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60. For the disposal of kitchen wastes, an effective crematory may be constructed by making a shallow saucerlike pit 10 feet in diameter, and 2 feet deep in the center, lined with stones. In the center build a cone of stones extending 2 feet above the surface of the ground. In the pit build a good fire of wood or brush. The stones soon become hot and rapidly dispose of liquid and damp stuff. Combustible refuse of the camp helps to maintain the fire. This form takes a good deal of fuel.

61. A separate place for the men to wash is necessary if the camp is to be occupied for more than one night. This place must not be near water supply or kitchens. Used water must not be thrown about on the ground, but thrown into a pit, from which it is drained by a ditch to a nearby stream, care being taken that it does not contaminate the water supply nor become a breeding place for mosquitoes. This method can be used in porous or gravelly soil. In impervious soil numerous shallow trenches may be run out from which the water can evaporate, or it may be necessary to haul it away.

62. Another method of disposing of garbage, which is both efficacious and economical as to fuel, is as follows: Each organization digs the trench for its cook fire with a slight inclination downward, from the end where the fuel is put in toward the end where the smoke comes out, and deep enough to admit of putting a layer of stones over the entire bottom, being careful to leave interstices between the stones. The garbage is poured upon these stones at the opening where fuel is put in and as near to the fire as practicable without extinguishing it. The liquid matter runs along the bottom of the trench under the hot stones and is gradually evaporated; the solid matter soon dries out and can then be shoved into the fire and consumed. The stones used should be as nearly round as practicable and from 3 to 6 inches in diameter.

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WATER SUPPLY.

63. For approximate daily requirements, see app. 7, p. 207, F. S. R. One cubic foot of water is 7½ gallons (a gallon weighs 8½ pounds).

64. The rough average yield of a stream may be measured as follows: Select some 12 or 15 yards of the stream where the channel is fairly uniform and there are no eddies. Take the breadth and average depth in feet in three or four places. Drop in a chip of wood and note the time it takes to travel, say, 30 feet. Thus obtain the surface velocity in feet per second. Four-fifths of this will give the mean velocity, and this multiplied by the sectional area will give the yield per second of cubic feet of water.

Contents of circular wells per foot deep: 3 feet (diameter), 53; 4 feet, 94; 5 feet, 147; 6 feet, 212 gallons.

PURITY OF WATER.

65. As the health of a force depends largely on the purity of the water provided, everything possible must be done to insure an ample supply of pure drinking water, and to keep it pure when obtained. It is mainly through drinking impure or contaminated water that cholera, dysentery, and enteric fever are contracted and spread. The water supply will always be selected in conjunction with the sanitary or other medical officer, who will satisfy himself as to its fitness for use. No water should be used for drinking purposes without being sterilized by filtration, by boiling, or by chemical means, if it has not been examined and pronounced pure by the sanitary or other medical officer.

66. Men must be prevented from drinking water from unauthorized sources, and they must be trained to economize the

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contents of their canteens, which, before marching, should be filled with coffee, weak tea, or sterilized water. Bad water drunk on an empty stomach is more dangerous than that drunk with a meal. Thirst is best assuaged by first moistening the lips and mouth, and only drinking a small quantity at a time. Large draughts of water should never be taken, as thirst is only increased thereby, and, if taken while the body is overheated, bad effects may follow.

67. Muddy water should be cleared of suspended matter before being boiled or filtered. The following methods may be used:

(*a*) Alum (5 grains to the gallon, or 1 ounce, equal to a heaped-up tablespoonful, to 100 gallons) stirred into the water and allowed to stand hastens the deposit of the suspended matter.

(*b*) Tack a sheet over a wooden frame so as to form a bag or basin; put a couple of handfuls of ashes in the bottom and then pour on the water, placing a receptacle beneath to catch the water which percolates through.

(*c*) Take two casks and place one inside the other, the outer cask pierced with holes at the bottom and the inner near the top; the space between is filled with sand and gravel. When these are placed in a stream, the water rises through the filtering material between the barrels and flows into the inner one.

68. Filtration aims at purifying water by holding back suspended matter, including germs.

69. To prepare a muddy well or stream for use, sink a large tin or box with small holes covered outside by cloth or muslin: top of box above water.

70. If water is too bad to drink, considerable relief from thirst is said to be obtained by immersing the arms in it.

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71. There are two ways of killing germs in water, viz., by heat and by chemicals.

Purification of water by heat can be secured by—

(1) Boiling in an open vessel, in which case it will be sufficient to bring the water to the boiling point.

(2) Heating in a special sterilizer.

The chemical substance chiefly employed for sterilizing water is chloride of lime.

Take a teaspoonful of bleaching powder (chloride of lime) and remove the excess powder by rolling a pencil, etc., along the top of the spoon. Dissolve in a cupful of water, making sure that all lumps are thoroughly broken up, and then add 3 more cupfuls of water to the solution. Stir up the mixture, allow it to stand for a few seconds to let any particles settle (this stock solution, if kept tightly stoppered, may be used for four or five days), and add 1 teaspoonful of this milky solution to 2 gallons of water to be purified. Stir thoroughly and allow to stand for 10 minutes. This will give one-half part of free chlorine to 1,000,000 parts of water.

One pound chlorine is sufficient for 66,000 gallons.

Chloride of lime deteriorates rapidly when kept in cardboard packages or exposed to the air.

72. Vessels or tanks in which drinking water is stored, in addition to being carefully covered, should be raised off the ground and provided with taps. Water carts and barrels require frequent cleaning and periodical disinfection.

To clean water receptacles, dissolve 1 teaspoonful of permanganate of potash crystals in 3 gallons of water and rinse with this solution until a permanganate pink color remains.

73. Posts on the lines of communication should arrange to have enough sterilized water on hand to supply the wants of detachments passing through.

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WATERING ARRANGEMENTS.

74. As a rule the military police, otherwise the first troops to arrive at a halting ground, will mount sentries on all water likely to be required for use, with such orders as will prevent any form of pollution. These sentries will not be withdrawn until permanent water guards are detailed.

75. The water supply should usually be marked with flags, as follows, by the advance party of engineers:

White for drinking water.
Blue for watering places for animals.
Red for washing or bathing places.

76. If water is obtainable from a stream, horses will be watered below the place where troops obtain their drinking water, but above bathing and washing places. Patrolling by mounted men will often be necessary for some distance above the spot where the drinking water is drawn.

77. If running water is not available, the supply must be very strictly protected, a rough barbed wire fence, if procurable, being run around it to keep animals out. Animals should, in this case, be watered by bucket or nosebag; and washing should be allowed only at some distance from the water supply, empty tins or other receptacles being used to draw water for this purpose.

78. If many animals have to be watered and the frontage is small, times should be laid down for each organization to water. Five minutes may be taken as the average time for watering an animal.

An officer should invariably accompany watering parties of more than 20 animals.

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FIELD COOKING.

(Pars. 284–312, F. S. R.; M. A. C., 1916.)

79. To prevent waste when the individual mess kit is used requires the closest supervision of issue of cooked rations by the mess sergeant, the cooks, and other mess personnel.

80. Contamination of food by flies should be prevented by the screening of kitchens and mess places or at least by keeping the food in screened cages. Scrupulous cleanliness of refuse receptacles and of the ground about them must be maintained. The use of lime and coal oil is efficacious. Breeding places of flies must be sought. Disturbance of these by raking or scraping is helpful. Precautions must also be taken to prevent food being ruined by ants and bugs.

81. Whenever practicable, supplies should be protected from the weather by canvas or other shelter. The less the handling of original or broken packages the better.

82. Economy and health are conserved by cooking by organization rather than by small groups or by individuals. Likewise, cleanliness can be insured only by requiring all men to congregate at one place for eating. Under no circumstances should food be taken to shelters of single men or small groups.

83. The equipment for cooking will be such that only boiling, stewing, or frying can be done unless improvised ovens are constructed. In the absence of fire irons provided with the equipment, narrow trenches of suitable width or trunks of green trees or rocks may be arranged as convenient substitutes.

When time is available an oven in a bank or a mud field range should be constructed. These should be provided with openings on top, over which boilers may be placed for cooking. With this type of oven the cooking may be done on the top and afterwards the coals withdrawn and baking done in the cham-

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ber, or they may used for baking and roasting only and the boiling otherwise provided for. By the latter method all portions of the meal may be provided at one time.

Another device which may be used is a simple range which is made by covering a suitable trench with a bake pan or two for a boiling surface and utilizing two or more coffee cans set end on for a flue. Beans may be baked in dugout ovens, clay ovens, or a vertical hole dug in the ground into which a jar or camp kettle containing them is placed and packed over and around with hot coals and earth.

84. Water may be kept cool without ice by using a canvas bag or a can wrapped with wet burlap or grain sacks. They should be kept in a draft, if possible, so as to increase the evaporation.

85. An ice box is often a great convenience and may be constructed by simply setting a dry-goods box inside of a larger one, preparing the necessary lids, and filling the space between the two boxes—4 to 8 inches—with sawdust, gunny sacks, leaves, grass, hay, straw, etc. Or even better, a single box may be set in the ground and packed around with the materials noted above or with solid earth.

86. *To boil* a joint, place it in boiling water and allow it to boil quickly for 10 minutes, then bring it to a simmer by pouring in cold water or reducing the fire. The average loss by boiling is 15 to 20 per cent. The time required to cook is about 15 minutes to a pound of meat.

87. Vegetables should be placed in boiling water with a little salt and boiled quickly until tender. Potatoes take from 20 to 30 minutes, carrots and parsnips 20 to 45 minutes. Dried vegetables should be soaked for about 4 hours and then boiled slowly.

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88. *Stewing* is not boiling. All that is required is a gradual simmering. This will make even tough meat tender and wholesome.

89. *Frying* is cooking with the aid of fats.

90. Meat may be *baked* as follows: Dig in the ground a hole of sufficient size and build a fire in it. After the fuel has become red hot put in the meat wrapped in paper in a clay case, or with the skin on, on a thick layer of green grass; cover it with green grass, hot ashes, and earth. Build a good fire over the meat and keep it going for about six hours. Unearth the meat and remove the skin. Meat treated in this way at night will be found cooked in the morning.

FIRELESS COOKERS.

91. The object of the fireless cooker is to prevent the loss of heat from food containing a sufficient number of heat units above 130° F. to cook it, thus effecting a great saving of fuel, and incidentally rendering it unnecessary for one to give his constant attention to the food being cooked. Furthermore, some articles are actually better when prepared in a fireless cooker.

It is generally a boxlike arrangement, lined with a nonconducting material, within which is the "well" or reservoir, into which the vessel containing the hot soup, coffee, meats, vegetables, etc., is placed.

Various materials—asbestos, paper, felt, hay, indurated fiber, etc.— are used as nonconductors.

92. To prepare food for the fireless cooker, the general idea is to place it on the range until the articles to be cooked are heated through, or have taken up such an amount of heat that when transferred to the cooker they will contain within themselves sufficient heat to complete the cooking.

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93. To get the best results, most articles of food to be cooked should be covered with liquid when put into the cooker.

94. Such vegetables as potatoes, parsnips, etc., should be about half cooked before putting in the cooker, the water drained off, and the tubers or roots allowed to finish cooking with the retained heat. Such articles should preferably remain in the cooker for a few hours only.

A considerable amount of acid is found in tomatoes, and dishes containing them in quantity should not be permitted to remain in the fireless cooker or other tin receptacle for longer than four or five hours.

95. Coffee and tea must have the grounds and leaves removed before transference to the cooker.

RECIPES.

96. *Kabobs.*—For a hurried meal meat can be quickly prepared by cutting into pieces about the size of a penny, but three or four times as thick. These can be skewered on a piece of wire or hard wood and roasted before the fire for a few minutes.

Stewed beef, mutton, or fowl.—Cut up the meat into thin slices or small pieces, the smaller the better, put a little fat into the bottom of the cooking pot, and when hot put in the meat. Stir till brown, add a sliced onion, carrot, or turnip, season with pepper and salt, add a little flour and some hot water, stir well, and allow to simmer slowly until done. Tomatoes, rice, and powdered biscuit in lieu of flour may be added.

Irish stew.—Ingredients: Meat, potatoes, pepper, onions, salt. Peel, wash, and slice the potatoes; peel, clean, and cut up the onions, cut up the meat into small pieces, place a little water in the kettle and a layer of potatoes at the bottom, then a layer of meat and onions; season with pepper and salt, then

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add another layer of potatoes and so on to the top, potatoes forming the top layer. Barely cover the whole with water and stew gently for about two hours.

Sea pie.—Ingredients as for Irish stew, with 5 pounds of flour and 1½ pounds of suet or dripping for every 20 men. Prepare ingredients as in case of stew, cutting the potatoes into slices lengthwise, and cover with paste, making a hole in the center. To make the paste, mix flour and water, roll and beat it out with the hands on a flat surface, adding a small teaspoonful of baking powder for each pound of flour. The paste should be about one-quarter of an inch thick. Time required to cook, about two hours.

Mutton or beef soup.—For six persons, 1½ pounds of meat, 1 onion, 2 carrots, 1 turnip, 6 tablespoonfuls of rice or barley. Cut the meat into small pieces, peel and slice the onion, clean and cut up the other vegetables, put a little fat into the camp kettle, fry the meat and vegetables a light brown color, add 5 pints of water and the rice or barley. Stew slowly for about one and one-half hours, and take off the scum as it rises, season with pepper and salt, and serve. When time does not admit, the frying of the meat and vegetables may be dispensed with. Semolina, tapioca, sago, macaroni, tomatoes, green peas, beans, lentils, etc., can be substituted for the rice or barley.

Beef tea.—Cut up about 1 pound of lean beef (no fat) into small pieces, put into a kettle, add 2 pints of cold water, boil slowly, removing the scum as it rises, cook for about two hours, longer if time admits, strain and serve.

Salt meat, when required hurriedly, should be cut into thin slices, placed in cold water, and brought to boiling point to abstract the salt; this may be repeated until the meat is found palatable. Salt meat treated in this way may, if time will allow, be used for stews in the same way as fresh meat.

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Stew made of preserved meat and vegetables.—Cut up the meat, removing all fat and jelly, powder up the vegetables, and put them in a kettle with water, cook until done, strain off most of the water, add meat and jelly, and season with pepper, salt, and a teaspoonful of brown sugar. Put on the lid, allow to heat through, then serve. The secret of making palatable dishes with preserved meat is only to heat it through, as cooking spoils it.

If fresh vegetables are obtainable, they should be fried first, then stewed and added to the meat.

Preserved meat soup.—Take 4 ounces of meat and half a biscuit per man with his allowance of preserved vegetables, cut up the meat, and powder the biscuit and vegetables. Put the vegetables into a camp kettle containing one-half pint of cold water per man, boil slowly, and add the meat and biscuit, and continue the boiling for a half hour, season with pepper and salt, if required, and serve; a quarter of a teaspoonful of brown sugar for each man may be added to improve the flavor.

Plain rice pudding.—Boil 1 pound of rice in 6 quarts of water for 30 minutes, season with a pinch of salt, strain, and preserve the water; put the rice into a dish, add 6 ounces of sugar, half a tin of condensed milk, a little of the water which has been strained off, stir well, and grate a little nutmeg or rind of a lemon on the top, place the dish on the embers, cover with a piece of tin, on this put some more embers, and bake for 20 minutes. If fresh milk is used, add 2 more ounces of sugar. If milk is not obtainable, the rice water alone may be used. If an egg is added, it should be beaten up with the milk or rice water; this is a great improvement.

Chupatties.—Mix some flour with water to make a stiff dough. Flatten a piece of the dough with both hands till it is about one-fourth inch thick. Melt some fat in the cover of a mess

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tin and when quite hot place the chupattie in it and leave until it is brown on both sides. On an average fire 1 pound of flour can be made into chupatties in one-half hour.

Bread made with baking powder.—Spread the flour out evenly, sift the baking powder over it, taking care to break up any small lumps. Mix powder and flour thoroughly. Dissolve salt at the rate of 1 ounce to 7 pounds flour in the softest water available. Mix with the flour and powder very thoroughly and place the loaves in a quick oven.

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CHAPTER III.

ORDERS.

(Pars. 84–95, F. S. R.)

97. Orders may be expressed in letters of instruction, field orders, general orders, orders, special orders, verbal orders, messages, either oral or written.

98. Orders must be clear and concise; precise as to time and place; expressed in correct and simple language; written legibly; positive, avoiding expressions of a conditional nature, as "dawn," "if possible."

99. Having written an order or message, read it through, and get some one else to read it, to assure yourself that it is clear.

100. The following is a brief outline of the main points to be covered in an estimate of the situation:

(1) Mission (concise statement of the object in view).

(2) Considerations affecting the enemy's forces.

(*a*) Strength and composition.

(*b*) Character.

(*c*) Location and disposition.

(*d*) Terrain (including roads and railroads).

(*e*) Supply, sources and state of; lines of communication.

(*f*) Other considerations (if any).

(*g*) Lines of action. (A consideration of possible lines of action by the enemy, and a determination of his probable line of action.)

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(3) Considerations affecting our own forces.

(*a*) Strength and composition. (Include a comparison with the enemy by means of simple ratios, as, infantry rifles, 3 to 2; guns, 1 to 1.)

(*b*) Character; include a comparison with the enemy.

(*c*) Location and disposition.

(*d*) Terrain (including roads and railroads).

(*e*) Supply, sources and state of; lines of communication.

(*f*) Other considerations (if any).

(*g*) Lines of action. (A consideration of the possible lines of action and a determination upon the best possible line of action.)

(4) The decision must be logical, definite, short, and *concise*.

101. The following models serve to illustrate field orders. It must be remembered that no two military situations are the same. These forms are useful servants, but must not become masters. (See Appendix 3, F. S. R.)

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FOR AN ADVANCE.

FIELD ORDERS } DET. I DIV.,
No. 2. } LEAVENWORTH, KANS.,
4 May 17, 8–15 p. m.

Map, Fort Leavenworth, scale 1/62,500.

Troops.

(a) Independent Cav.:
Col. A
1st and 2d Sqs. 1st Cav. (less 1 tr.)
(b) Adv. Gd.:
Col. B
1st Inf.
1 tr. 1st Cav.
Btry. B, 5th F. A.
Det. Co. A, Engrs.
Det. Amb. Co. No. 1.
(c) Main body—in order of march:
1st Bn. 2d Inf.
1st Bn. 5th F. A. (less 1 btry.)
1st Brig. (less 1st Inf. and 1st bn. 2d Inf.)
4th Inf. (less 1 co.)
Co. A, Engrs. (less det.)
Amb. Co. No. 1 (less det.)
F. Hosp. No. 1.
(d) Det. 1st Bn. Sig.

1. The enemy's cavalry patrols have been seen north of KICKAPOO. His infantry and artillery are reported at ATCHISON. Our Division is 8 miles south of LEAVENWORTH.

2. This detachment will march to-morrow to KICKAPOO.

3. (a) The independent cavalry will start at 6:00 a. m., covering the movement.

(b) The advance guard will clear the northern exit of LEAVENWORTH at 6:30 a. m., marching by the ATCHISON CROSS-FRENCHMAN road.

(c) The main body will follow the advance guard at 1,200 yards.

(d) The Det. 1st Bn. Sig. will establish a line of information along the line of march between the independent cavalry and LEAVENWORTH, one of the stations being at FRENCHMAN.

4. The field train, escorted by one company, 4th Inf., will follow the main body as far as FRENCHMAN.

5. Messages to head of main body.

By command of Brig. Gen. One:
JOHN JONES,
Chief of Staff.

Copies in person to Staff; to Cols. A, B, One, Five, and Capt. Engrs., by Lt. C, Aide; synopsis by wire to Maj. Gen One, at Kansas City.
Copy No. 1.

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DURING A HALT ON THE ROAD BEFORE COMPLETING THE DAY'S MARCH.

FIELD ORDERS } III DIV.,
No. 7. } ALLENTOWN, PA.
5 May 17, 2–15 p. m.

Map:—Allentown, 1–10,000.

1. No further information of the enemy.

2. The Division will rest two days, 6 and 7 May.

3. The camp for to-night will be on the east bank of BEAVER CREEK, the leading regiment of the main body halting just south of BEEVILLE.

The reserve of the advance guard will bivouac at ELLISTON'S FARM.

Outposts will be established along the line BELLEVUE-JACKSON-FIELDING.

Cavalry patrols will reconnoiter through BERKELEY HILLS.

4. Field trains will join organizations; other trains will park east of KERNSTOWN.

5. Division Headquarters will be at schoolhouse, BEEVILLE.

By command of Maj. Gen. Three:

WILLIAM SMITH,
C. of S.

Copies to Staff by Lt. A, Aide; to Brig. Gens. Eight, Nine, and 3FA, by Lt. B, Aide; to Brig. Gen. Seven, and Col. 3C, by radio; to Col. 3 Engrs., by Sgt. H; to Maj. 3 Sig., and Col. Tns., by Corp. H, on motorcycle.

Synopsis by wire to Corps Headquarters.

Copy No. 1.

INTERCOMMUNICATION.

102. The possibility of thorough cooperation depends upon the constant maintenance of communication between the various parts of an army. The means of communication must be carefully organized in each unit.

103. Subordinate commanders keep their immediate superiors and adjoining commanders informed of the progress

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of events. Commanders arrange for communication with and between their subordinates; subordinates see that they are provided with the necessary means, and must improvise the best arrangements when necessary.

104. Commanders of battalions and larger units, of detachments, and of other bodies of troops when advisable, establish headquarters where messages can be received and acted on during their temporary absence. The location of such points will be made known to all concerned, and, where necessary, will be indicated by placards or other marks of identification, care being taken not to furnish hostile aviators with valuable information by this means.

105. When a commander leaves the main body of his command for any length of time he details an officer with the necessary staff to act for him in his absence.

106. All persons connected with the military establishment are responsible for doing everything in their power to keep the means of intercommunication intact. Great care must be exercised by all not to damage field wires or other lines of information.

107. Commanders of districts through which telegraph or telephone lines pass are responsible for their protection and the prevention of tapping.

108. The service of intercommunication is carried on by—

(1) The Signal Corps.

(2) The intercommunication personnel forming parts of other units.

THE SIGNAL CORPS.

109. Those duties of signal troops which relate to the matter of intercommunication require that the chief operator of any signal station, established in the theater of operations by proper authority, shall accept and send all authorized messages turned

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over to him for transmission. He must likewise deliver all authorized messages received by him or his assistants to the persons for whom intended. He is governed only in these matters by the regulations of the Signal Corps and such special rules as may be prescribed by the commander of the division or detachment in the field to which his company belongs.

110. The willful disclosure or changing the wording of the contents of any message, or the destruction of or delay in the delivery of same, is a violation of the law, punishable by fine and imprisonment. Orderlies and messengers, detailed from the combatant troops, and all operators and other employees of the signal troops, should be cautioned accordingly.

111. No message, Government or private, will be made public, except by proper authority, and under no circumstances will the contents of any message be divulged by anyone except those authorized to do so. Even the fact that a message has been received will not be allowed to become known.

112. Government operators will be held responsible that all messages are carefully guarded and that no unauthorized person has access to the files. Messages leave the office which received them in sealed envelopes, addressed to the persons for whom intended.

113. The operator in charge, or the chief operator, will refuse to admit to the operating room any person not employed at the office, unless such person has obtained proper authority beforehand to visit the same or comes there on legitimate business.

114. Signal lines of information will be used for routine communication only in cases of imperative necessity, where the delay incident to transmission by the mails or other established lines of information would be detrimental to the public interests.

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115. In sending the same message to several different addressees, it will facilitate matters if a copy for each addressee is handed to the operator by the sender.

116. In framing messages, the same rules as to clearness and conciseness will be followed as in the case of writing orders. The writer will cut out all superfluous words not needed to make the communication easily understood.

117. In using the telephone not conversations but messages should be resorted to.

118. Signal lines of information are classified as aerial, electrical, and visual.

119. Aerial lines are those carried on by means of the use of aircraft.

120. Electrical lines comprise telegraph, telephone, and radio methods of communication.

120. Visual signaling comprises messages sent by flags, lanterns, rockets, colored lights, heliographs, and searchlights.

It is the duty of the troops of the Signal Corps to establish and maintain airplane, radio, telegraph and telephone receiving and sending stations in the theater of operations, and to construct and keep in repair the lines of information joining these. In special cases they may also be called upon to establish and maintain stations for visual signaling and to operate the same; but they must be assisted in this by details made from the combatant troops in order that they may properly perform the more important tasks of establishing, maintaining, and operating electrical lines. To this end it is important that each unit of the mobile army should have some men instructed in visual signaling.

122. The Signal Corps makes use of all commercial lines found in the theater of operations. For this reason troops in the field are warned not to damage such lines unless properly authorized to do so.

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123 Electrical wire lines may be constructed if the wire and poles are available. Ten men under favorable conditions can erect about 2 miles per day.

124. The most valuable means of communication found in our Army is the insulated field wire with which all field battalions of signal troops are supplied. It is laid on or near the ground and can be used as a buzzer, telephone or telegraph line. It can be laid at the rate of 5 miles per hour.

Visual lines of information depend upon the power of human vision for their length. Inclement weather, mist, fog, rain, and dust tend to shorten these distances. The following may be taken as a rough guide as to the distance between stations where conditions are favorable and stations are well located as to visibility: Headgear or semaphore, 1 to 2 miles; lanterns, 5 to 10 miles; flags, 3 to 5 miles; heliograph, 40 to 80 miles.

125. For duties of signal troops in campaign, see Bulletin No. 4, C. of S., 1914.

126. Official messages will have precedence. The following is the usual order of priority:

(*a*) Movements of the Army and Navy in the field.

(*b*) Other messages relative to the Army, the Navy and the governmental departments and bureaus of the United States.

(*c*) Messages of State, Territorial or other civil officials on public business.

(*d*) Messages between diplomatic agents of neutral powers.

(*e*) Press messages.

(*f*) Miscellaneous (those relating to sickness and death having priority).

127. Rules for caring for copies of the War Department Telegraphic Code, which may come into possession of officers of the Army, will be found in par. 1185, A. R., 1917. Officers only are allowed to send messages in code or cipher.

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INTERCOMMUNICATION PERSONNEL, COMBATANT UNITS.

128. This personnel may be regularly assigned to that duty but it is often composed of officers and men temporarily detailed for this purpose.

129. During operations, it is desirable that each organization of a command should have an agent, with the necessary orderlies, at the headquarters of the next higher organization for the purpose of keeping in touch with the tactical situation. This agent, from time to time, transmits important information to his immediate commander, thereby keeping him oriented as to the general progress of the engagement and the movements of the neighboring troops.

130. It is the duty of each organization commander to keep his next higher commander informed of everything of importance happening in his vicinity. He should also keep in touch with friendly organizations on his immediate flanks. This coordination is usually accomplished by means of visual signalling or the use of messengers. Every organization in the Army should have some men trained as signallers.

131. Messengers may be mounted or dismounted or they may travel by bicycle, motorcycle, or motor car. If the messenger is required to carry a verbal message, he should be made to repeat and interpret the same before setting out. If it is written, and there is danger of his having to destroy it to prevent the enemy from getting it, he should know its substance.

132. The route to be taken and the rate of travel are designated. Prominent landmarks, points where hostile patrols have been seen, and places of special danger should be mentioned and their locations pointed out on the map. The point where the addressee may be found should also be designated. If the

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message is to be relayed, the location of the next relay station must be given. The messenger should know whether he is supposed to show the message to bodies of friendly troops encountered en route.

133. More complete instruction to messengers and to commanders of relay posts will be found in par. 36, F. S. R., and under the head of "Information" in this pocket book.

134. U. S. ARMY FIELD MESSAGE.

Time filed	No.	Sent by	Time	Received by	Time	Check
		These spaces for signal operators only				

From Patrol No. 1.
At 500 yds. S. E. CHOUKES.
Date 20 Oct. '15. Hour 10–45 A. M. No. 1.
How sent: Foot messenger.
To C. O. Co. A.

Hostile cavalry patrol six men now south of OFFERTS moving east on SCHAPER-NOTTINGHAM road. Will remain in observation.

LEHMAN, *Sergt.*

135. MODEL FOR RECORDING MESSAGES PASSING RELAY POINTS.

No.	Date.	Subject.	Received.			Sent.			Remarks.
			When.	From.	Where.	When.	By whom.	Where.	When has rider returned.

(Indicate when relay posts are posted; when relieved.)

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136. Table to calculate time required to transmit a message. Abbreviations indicate the following:

r = time in minutes required for messenger to go 1 mile.

R = time in minutes required for troops to which messenger is going to march 1 mile.

d = distance in miles between messenger and troops when messenger starts.

M = distance in miles troops will march before receiving message.

min. = time in minutes required for delivery of message.

(A)					(B)				
The messenger and troops approaching each other.					The messenger and troops moving in the same direction.				
r	R	d	M $\frac{r \times d}{r+R}$	min. $\frac{r \times R \times d}{r+R}$	r	R	d	M $\frac{r \times d}{R-r}$	min. $\frac{r \times R \times d}{R-r}$
12	20	1	$\frac{3}{8}$	$7\frac{1}{2}$	12	20	1	$1\frac{1}{2}$	30
12	20	2	$\frac{3}{4}$	15	12	20	2	3	60
12	20	3	$1\frac{1}{8}$	$22\frac{1}{2}$	12	20	3	$4\frac{1}{2}$	90
12	20	4	$1\frac{1}{2}$	30	12	20	4	6	120
12	20	5	$1\frac{7}{8}$	$37\frac{1}{2}$	12	20	5	$7\frac{1}{2}$	150
$7\frac{1}{2}$	20	1	$\frac{3}{11}$	$5\frac{5}{11}$	$7\frac{1}{2}$	20	1	$\frac{3}{5}$	12
$7\frac{1}{2}$	20	2	$\frac{6}{11}$	$10\frac{10}{11}$	$7\frac{1}{2}$	20	2	$1\frac{1}{5}$	24
$7\frac{1}{2}$	20	3	$\frac{9}{11}$	$16\frac{4}{11}$	$7\frac{1}{2}$	20	3	$1\frac{4}{5}$	36
$7\frac{1}{2}$	20	4	$1\frac{1}{11}$	$21\frac{9}{11}$	$7\frac{1}{2}$	20	4	$2\frac{2}{5}$	48
$7\frac{1}{2}$	20	5	$1\frac{4}{11}$	$27\frac{3}{11}$	$7\frac{1}{2}$	20	5	3	60

CARRIER PIGEONS.

137. Carrier pigeons have in many cases brought in most important information through a heavy barrage of artillery fire and through gas clouds when no other means of communication was practicable.

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To obtain full value the principles of the use of this service and the care of the birds must be thoroughly understood by all concerned.

ORGANIZATION OF CARRIER PIGEON SERVICE.

138. The service consists of *lofts*, *pigeon stations*, and *mobile pigeon* stations.

Lofts are places in which pigeons are normally kept and to which they home or return when released elsewhere. They are stationary, motor mobile, or horse-drawn mobile.

Stations are places to which pigeons are taken whence they are released with messages as required.

Pigeon stations are established with the infantry; mobile pigeon stations with the cavalry.

139. When a new loft has to be built and stocked with young birds it takes six weeks to train the birds before they can be flown from the trenches.

140. In the case of mobile lofts, it takes a week for the birds to settle down after the loft is established in a new position. In addition, birds should be trained for another week on the new line they will have to fly. It will thus take about two weeks from the time the loft is moved before the birds are fit to fly from the trenches.

141. For continuous work it is necessary to provide at least three times as many pigeons as it is desired to keep in the trenches at any one time. This will allow for casualties and for the pigeons to have at least two days in their lofts for every two days in the trenches. For short periods of special pressure this proportion of rest may be decreased, but if it is decreased for any length of time the pigeons will suffer.

142. A man can be trained to handle and fly pigeons in four days.

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148. Birds can be kept in the stock baskets, holding eight birds, if necessary up to seven days. They suffer from the confinement, and if kept in baskets for any long period will require many days rest in the loft to recover.

Birds can be kept in the infantry pattern basket, holding two pigeons, for not more than 48 hours, at the end of which time they should be released.

CARE OF PIGEONS AFTER THEY HAVE LEFT THE LOFTS.

144. From the lofts the birds are sent out in stock baskets, if possible. Food and message carriers are sent with them. Each basket should have a label attached giving the date the birds left the loft.

145. Cock birds are marked RED, hen birds BLUE. Cock and hen birds are not to be placed together in an infantry basket, nor in the same compartment of a stock basket. Cock and hen birds are not to be released together.

146. Transfer to baskets must be done by a man trained to handle pigeons. When taking a bird out of a basket, handle him gently, pinioning his wings with one hand. Take the bird out head first, and not tail first, as more wing flights are broken through this than through any other cause.

147. Pigeons must be kept as much as possible under shelter. A bird whose wings are caked with mud is unable to fly.

148. No food must be given other than the pigeon food sent out with the bird. Birds should not be fed until they have been 24 hours away from their lofts. They should be fed only once a day, half an hour before sunset. The water trough must be kept filled with clean water.

149. The message carrier is to be attached to the leg of the pigeon which has no identification ring, and care must be

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taken not to pinch the clips of the carrier so tight as to stop circulation.

150. Gas-proof covers are to be kept on the baskets, but should be raised so as to cover the baskets completely only when there is gas about; at other times they should be kept down so as to allow the free circulation of air to the pigeons.

DISPATCH AND RECEIPT OF MESSAGE.

151. A pigeon station should be allotted to a definite commander, such as a battalion or company commander, who is then responsible for the messages sent. If possible he should sign each message himself as a proof that they are sent by his order. This officer will also be responsible that the pigeons are kept in a suitable place and cared for. Neglect of the birds will lead to bad flights, and may endanger important messages. When a unit which has a pigeon station is relieved by another, the pigeon station and its equipment should be turned over to the commander of the incoming unit.

152. Before deciding to send a message by carrier pigeon it is necessary to consider the importance of the message, the number of birds available, and the prospect of getting more up, also whether the message can be sent by other means. As pigeons are intended primarily to provide a means of communication for important messages when all other means have broken down, they should usually be reserved for an emergency.

153. Pigeons can not be relied on to home the same day if released less than one hour before sunset. Pigeons will not home at night. They should not be released before sunrise, and if there is a thick morning mist or fog, they will not reach their loft, and it is better to keep them until it has cleared off.

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154. Pigeons which have been roughly handled, have had their wing flights or tail feathers broken, have not been fed and watered, have been wet, and especially if they have gotten caked with mud, will make bad flights and may even fail to reach their lofts.

155. The personnel in charge of a loft are responsible, when a pigeon comes in, for promptly taking the message carrier from the pigeon and turning it over for disposition.

CAUSES OF FAILURE.

156. (*a*) Omission to allot pigeon stations definitely to commanders, and to fix responsibility for messages to be sent.

(*b*) Baskets of pigeons sent from lofts to a specified place where they were to be met by the men from the pigeon stations, and no one there to meet them.

(*c*) Baskets not turned over to officer or responsible noncommissioned officer, and birds allowed to lie neglected for several days.

(*d*) Neglect to water and feed birds while away from their lofts.

(*e*) Pigeons caked with mud.

(*f*) Messages illegibly written, not timed, and not signed by an officer.

DISTANCES AND RATES OF TRAVEL.

157. Pigeons fly at a speed of 19 miles, and under favorable conditions 25 miles per hour. They fly at a height of about 300 to 400 yards. Longest distance, about 300 miles.

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INFORMATION.

(Art. I, Part II, F. S. R.; Part I, E. F. M.)

158. *Timely information* regarding the *enemy's* forces and the *topography* of the theater of operations is essential.

159. *Information of the enemy* under the following heads is requisite:

(*a*) Strength and composition.

(*b*) Character.

(*c*) Location and disposition.

(*d*) Sources and state of supply; lines of communication.

(*e*) His possible lines of action and his probable intentions.

160. *Knowledge of the terrain* under the following heads is necessary:

Roads, railroads, streams, bridges, fords, hills, mountains, forests, soil, villages, buildings, defensive positions, water resources, camping places.

161. Information in the field is secured by—

(*a*) Reconnaissance.

(*b*) Examination of inhabitants, newspapers, letters, telegraph files, prisoners, deserters, spies, maps.

(*c*) Secret service.

Reconnaissance is the most important of these.

RECONNAISSANCE.

162. By *reconnaissance* is obtained information with regard to—

(*a*) The topographical features and resources of the theater of operations.

(*b*) The movements and disposition of the enemy.

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163. Reconnaissance of the enemy may be—

(*a*) *Strategical.*—To locate the hostile columns and ascertain their strength and direction of march before the opposing armies are within striking distance.

Seek the enemy. Report first contact with him, roads occupied by hostile columns, direction of march, objectives already attained, strength of columns by compilation or estimation (composition of advance guard will often aid in estimating strength of column).

Information of enemy and not conflict with his patrols is the desired end.

(*b*) *Tactical.*—To discover the tactical dispositions of the opposing force when two forces are within striking distance.

Ascertain location of flanks, position of artillery; location and movements of reserve; approach of probable reinforcements.

Reconnaissance must be depended upon to obtain the information upon which all tactical movements of troops will be based.

164. Contact with the enemy once gained must not be lost. Strength of patrols is dependent upon the strength necessary to accomplish the mission and upon the number of probable messages that will be sent back. Information must get back to the commander or it is of no value, hence all in advance must know where messages are to be sent, location of posts for the collection of messages, relay points, etc., so far as is necessary for the work in hand.

165. Signal troops must have necessary information to run lines that will fit in with the above.

166. Since it is desirable to drive the enemy from the field, hostile horsemen should always be attacked wherever they appear, *unless secrecy is desirable.* This will aid our own work and interfere with his.

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167. Transmit information to neighboring detachments whenever possible.

168. While the advanced troops are engaged with the enemy, information may be obtained by the air service; by personal observation by the commander; by officers' patrols, or by scouts.

169. In questioning hostile inhabitants, prisoners, deserters, and others it is well to take them separately out of hearing of others, to let them suppose that a great deal more is known by the questioner about the enemy than is possibly the case, and that questions are being put to test their veracity, the answers being known. The examination should be conducted by more than one person.

170. People not accustomed to seeing large bodies of troops are apt to exaggerate their strength. Scouts should be careful to avoid this.

171. Fires by night and columns of smoke by day are sometimes used for signaling. Puffs of smoke are made by lighting a fire of damp wood and alternately covering and uncovering it with a wet blanket.

172. Tracks of feet, hoofs, or wheels give warning of patrols or troops being about; show the direction and speed of the force. Note whether they are fresh or old. If hoof tracks, note whether horse or mule.

173. Sound travels 1,086 feet a second. About 1 mile in five seconds. Note the time between the flash and peal to estimate the approximate distance. If there is no watch available count in quick-time cadence and divide by two to get the number of seconds between the flash and report.

174. The presence of men or animals may be detected by odors.

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175. A patrol leader observes very carefully the road he travels, the crossroads and paths, looking for a route by which to return should he be cut off.

176. He notes villages, spires, boundary marks, woods, streams, ditches, piles of stones, lone trees, pools, or other landmarks by which he may guide himself upon his return.

177. He turns at intervals and observes the terrain over which he has come, the better to fix in his mind the appearance it will have on his return. The habit of sketching is a powerful aid to the memory. The patrol leader must not put absolute confidence in the map furnished him. The older the map the less exact is it. It is a useful guide rather than an exact representation.

178. Definite information is specially important when tactical questions are dealt with. Do not say that a certain ridge forms a defensive position. State the limits of the position, the force required to hold it, nature of ground in front and flanks, and of soil for digging; localities which would afford good artillery positions or observation stations for our own or enemy's troops; points from which an extended view is obtainable; average field of fire; best lines of attack and of counterattack; communications and water. In order to make a good tactical reconnaissance ascertain before starting the particular object of the reconnaissance.

RECONNAISSANCE REPORTS.

179. Make the report clear and concise. Do not repeat anything that is shown on sketch.

Put as much as possible of the desired information on the sketch. It is clearer and briefer.

Confine the information to what is relevant.

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Distinguish between what are known to be facts, what is hearsay (giving the source), and what is deduced from known facts.

180. When names of localities are spelled in various ways, or when spelling does not conform to the pronunciation, the latter is shown phonetically in parentheses, thus Bicester (Bister), Gila (Hee-la). Print names of places in CAPITALS.

ROAD RECONNAISSANCE REPORT.

181. The information should supplement that on the available maps. Number paragraphs serially. Place reference numbers on sketch in parentheses. It is well to place all of the reference numbers on the sketch before writing report, so that these references will extend from beginning to end in order and thus be easily referred to.

182. A road reconnaissance should procure data on the following:

(*a*) *The road.*—Gradients, especially the steepest; width of roadway; if paved, width, kind and condition of paving; whether material for repairs is at hand; width and depth of side ditches, and whether wet or dry; if not paved, character of soil, sand, clay or gravel; kind of fences and width between them. The sketch should show whether the road is an embankment or cutting; where wagons can not double or pass, and where foot-troops can not march along the side between the wagon track and fences; commanding heights within infantry or artillery range. Whether bridges are wide enough to admit of marching in double columns. If road passes through town, give names of streets to be followed.

(*b*) *Bridges.*—Material of piers and abutments; type and material of superstructure, as girder, truss, arch, suspension, wood,

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steel, stone; width of roadway, and clear headroom; height above ground or water; safe load; whether it will bear motor transport; clear width and height of bridges over road; nearest bridges or ford up and down stream, and whatever information can be obtained about them. If bridge is destroyed or damaged, whether banks can be cut down and stream forded; location of material to make repairs.

(*c*) *The country.*—Character of cultivation or natural vegetation; areas and density of timber, underbrush, vines, especially poisonous ones; marshes and fords; kinds of fences; nature of soil; general configuration of surface, especially long hills, long ridges or valleys, bluffs or slopes too steep to scale, and practicable routes to their crests; places from which a view can be obtained, with direction and extent; names of distant objects that can be identified, as churches, country houses, with direction and distance.

(*d*) *Streams crossed.*—Name, location, width, depth, surface velocity of current; velocity noted as sluggish, moderate, swift; elevation of high-water marks in relation to the road; which bank is higher at crossing and above and below the crossing, and how much; accessibility of water for stock; number of animals that can be watered simultaneously; fords at or near crossing; length, depth, and steepness of approaches; levees or embankments, height and thickness on top; if navigable, to what distance above and below, and for what class of vessels.

(*e*) *Towns and villages.*—Name, location on map, and population; names of streets to be traversed; material, as stone, brick, frame, log; size, as one, two, three stories; distribution, close or scattered, of houses in those streets; gradients of intersecting streets; location of railway stations, post office, telegraph and telephone offices; drinking fountains and watering

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troughs; depots, elevators, storehouses; flour mills; canneries; accumulation of food and forage; blacksmith, wagon, and machine shops; stocks of gasoline and oil; automobile garages; number and kind of motor vehicles. If ordered to make a complete examination of a town or village, note besides the foregoing, location and size of principal buildings, halls, courthouses, schoolhouses, churches, banks, jails, and their ownership; sources, quantity, and method of distribution of water supply; sanitary conditions and method of disposal of wastes; capacity of railroad depots, sidings; location and extent of open spaces and of large substantial buildings standing apart; location and extent of high ground within range; points from which streets can be enfiladed; system of administration; names of influential persons.

(*f*) *Railroads crossed.*—Name, location, gauge, single or double tracked; length of sidings; loading platforms; loading chutes; crossing at grade, over or under; distance to and name of nearest station each way; direction of nearest roundhouse, shops, watering tanks; material of station buildings, their command of surrounding country, their defensibility; location of turntables and wyes.

RIVER RECONNAISSANCE REPORT.

183. Owing to the variety of tactical uses to which a river can be put the particular object of the reconnaissance must be ascertained before starting and the report made accordingly.

184. If in the center of the stream and facing down stream, the bank on the right hand is the right bank, that on the left hand the left bank.

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185. A river reconnaissance should procure data on the following subjects:

(*a*) *The valley.*—General configuration, heights of limiting ranges, and location of roads or passes crossing them; commanding ground from which a stretch of the channel can be enfiladed by artillery; forest growth on or near banks; soil and cultivation of valley; roads parallel to river and means of access to them from river. Material available nearby for building crossings.

(*b*) *The stream.*—Width, depth, velocity, navigability, whether tidal, head of navigation for each class of vessels; nature of obstructions to navigation, and possibility of removing or avoiding them; aids to navigation; season of high and low water, average rise and fall; rapidity of rise and fall and causes; amount of drift; character of banks and relative command; quality of water, amount and kind of sediment borne; usual period of ice; thickness of ice.

(*c*) *Tributaries and canals.*—Width, depth, navigability, means of crossing; nature and purpose of canals; dimensions and lift of locks; time for lockage; means of destroying locks, and effects of destruction; floating plants.

(*d*) *Bridges and fords.*—As in road report. For bridges, note position of the channel and its navigable width between piers; height of arches and lower chords above water at different stages; dimensions and means of operating draw spans.

Note the exact positions of fords and the marks on both banks by which they may be found; length, width, and nature of bottom; velocity of current; position of deep holes; aids to crossing.

Note nature of approaches to bridges and fords; width of roadway, slopes, soil, effect of water, and traffic; defensibility. Repair material available.

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(*e*) *Ferries.*—Position and approaches, practicability for horses, wagons, and artillery; size, number, and kind of boats; method of propulsion; sites for bridges or ferries; islands; materials for repair.

RAILROAD RECONNAISSANCE REPORT.

186. (*a*) *The line.*—Local name, terminal points; gauge; single or double track; condition of roadbed, ties, and rails; drainage, liability to washouts; material for repair; condition of right of way for marching troops.

(*b*) *Tunnels.*—Location; dimensions; means of destroying.

(*c*) *Bridges.*—Same as in road reconnaissance.

(*d*) *Rolling stock.*—Number and kind of engines and cars; capacity for transportation of troops; location and capacity of shops and yards.

(*e*) *Stations.*—Name and location; facilities for entraining and detraining troops with wagons, horses, and artillery; platforms; ramps; sidetracks, number and capacity; turntables; water tanks; fuel; storage; derricks; crossings for teams and pedestrians; places for hospitals, camps, depots; facilities for feeding and watering men and animals; making coffee; lighting systems.

(*f*) *Miscellaneous.*—Telegraph and telephone lines and offices; connecting railroads; source, quantity, and quality of water; defensibility of right of way.

RECONNAISSANCE OF A WOOD OR FOREST.

187. Note all roads and paths, and all hills, ravines, and streams within the wood or skirting the edges; kinds of trees, density of growth; underbrush, prevalence of poisonous shrubs and vines; marshy or large open spaces; practicability of form-

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ing new roads by cutting; creation of obstacles by felling trees; if there are no roads, traverse the shortest practicable path between the point of entrance and the point of exit, and mark bowlders or blaze trees, set stakes or otherwise indicate this path, and also give compass bearings of the route to be followed. Note the exterior forms of the woods, whether parts of the edge flank other parts; connection with neighboring pieces of wood by scattered trees or clearings; undulations of the ground that would give cover to attacking force or to defenders.

RECONNAISSANCE OF A POSITION.

188. The length of the position should be noted and the proper force for its occupation stated. Note features that exist to secure the flanks. Note the depth of the position and the cover afforded for supports, reserves, and trains. Note cover existing for the component parts of the force, whether natural or artificial, fences, ditches, trees, etc. If digging is necessary, the amount and the character of the soil should be stated. Note strong points in front of the line; communications perpendicular and parallel to the front; artillery positions; ranges at which the enemy may be seen and reached by artillery fire.

189. A position occupied by the enemy must be reconnoitered from a distance and few details can be actually seen. Valuable inferences may be drawn by remembering that the enemy has probably chosen his position according to the above principles. Special attention should be given to the flanks and to the feasibility of turning one of them.

RECONNAISSANCE FOR A CAMP.

190. Note site, location, elevation, and area; sanitary features, such as drainage, dryness, and general character of top

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soil; proximity of swampy ground or stagnant ponds; communications; sufficiency of existing roads and paths, maximum grades, probable condition under heavy traffic and in bad weather, location and kind of materials available for improvement or repair; railroad or water communications and terminal facilities of same; location, kind, and quantity of fuel at hand; quality and quantity of water, facilities for filling water carts, for watering animals, and for washing and bathing; nature of supply, as wells, springs, running streams, and its reliability. Proximity of trees, brush, wood, hay and straw for huts and bedding; of markets; of towns and villages.

PATROLLING BY AIRCRAFT.

191. Patrolling by aeroplanes and balloons supplements but does not replace other methods of reconnaissance.

192. Contact patrol work by aeroplanes is useful—

(*a*) To bring in information of the progress of troops during the attack.

(*b*) To report the position of the enemy opposing the advance, the movements of his reserves, and the state of his defenses.

(*c*) To transmit messages from troops engaged to their headquarters.

193. To secure effective cooperation, observers must be fully informed as to the plan of attack, the dispositions of troops with whom they are working, and their objectives. Before beginning his flight, the observer should visit the unit with which he is to operate, in order to obtain all the detailed information possible. His watch must be synchronized with that of the commander of the unit.

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194. Aeroplanes detailed for contact patrol work must be plainly and specially marked, and the markings made known to all ranks of the unit with which working.

195. Prior to the attack, contact patrol aeroplanes keep the commander constantly informed of the progress and results of the artillery bombardment, while after the attack begins they can discover the enemy's fresh dispositions and sometimes his strength at various points. All available information must be given the observer before he starts.

196. At an altitude of 1,500 feet or less an aeroplane is almost certain to be hit by rifle or machine-gun fire from the ground, unless the enemy is fully occupied in fighting. Commanders must decide, before sending the observer up, whether the importance of the information sought is sufficient to justify the risk of losing a good pilot. When giving orders, the degree of importance attached by the commander to the information sought must be explained to the observer, who will be able to judge of the risks he will be justified in incurring.

197. Heights from which various objects can be seen in a good light:

From 3,000 feet:

An attack can be followed.
Bombing can be seen.
State of trenches can be reported upon, as to whether badly damaged by bombardment or not.
Trench mortar emplacements can sometimes be seen.
Tracks can be seen.

From 2,500 feet:

Men massed in trenches can be seen.
It can sometimes be seen whether a trench is revetted or not.

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From 2,000 feet the following can be seen:

Wire in good light, but not its condition.
Overhead traverses.
Sandbags.
Comparative width of trench.

From 1,500 feet:

Dugout entrances.
Comparative depth of trench.
Men making signals, such as waving their helmets.

From 1,000 feet or under our own troops can be distinguished from those of the enemy.

SECURITY.

198. (Pars. 37–83, F. S. R.)

199. The service of security is closely connected with the service of information in that the latter service always makes possible a more efficient provision for the former. Provisions for security in accordance with general principles and regulations, but without reference to information of the enemy, must necessarily be excessive as a whole, or else fail at some specific point where ordinary arrangements are insufficient to meet some extraordinary danger.

200. The general principle in security on the ground is that a minor portion of the whole command shall endure the strain of constant action or alertness during a given period of time, while the major portion of the command conserves its energies for combat.

201. The larger the force of troops involved in a military operation the greater is the subdivision made in the security formations, the outer elements of which bear the strain of constant action or alertness. This strain is intended to be propor-

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tionally less in each intervening element until the main body may pursue its progress on the march or its routine in camp with the least possible stress upon its morale or energy.

202. Reconnaissance in the air supplements security on the ground but can never replace it. Aeroplanes protect their own troops in proportion to the measure of information they obtain of the enemy positions and strength and to their success in preventing hostile aeroplanes from observing and gaining information for their own forces.

203. Under present development of air reconnaissance, concealment becomes a more important factor of security than ever before. It must be kept constantly in mind and be resorted to by all methods and means at the disposal of commanders of troops or trains.

For forces on the march, especially large forces, concealment is seldom possible, and in this case aeroplane scouts must be depended upon to drive off enemy scouts before they get opportunity to observe.

204. For troops and trains in camp a measure of concealment is often possible, such as camping in wooded areas, using existing buildings for billetting troops in order to reduce the area of canvas spread, and covering the artillery and trains with brush or other screens. If the enemy scout gets the impression of a smaller force than actually exists this measure of concealment has had some value.

205. For troops and armament in position for attack or defense, especially the latter, concealment has its greatest value as an aid to security. No effort should be spared to provide the greatest possible concealment, which, under this condition, becomes practically the same as security.

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MAP READING.

(Par. 34 F. S. R.; par 89–90, part 1, E. F. M.; Military Map Reading, Sherrill.)

206. *Scales.*—There are three methods by which the scale of a map may be represented:

(*a*) By words and figures, as 3 inches=1 mile; 1 inch=600 feet.

(*b*) By *representative fraction* (R. F.), which means that 1 unit on the map (numerator) represents a certain number of the same units on the ground (denominator). For example; R. F. 1/63,360 means that 1 inch on the map represents 63,360 inches or 1 mile on the ground. R. F. 1/21,120 means that 1 inch on the map represents 21,120 inches or one-third of a mile on the ground; or 3 inches represents 1 mile.

(*c*) By *graphical scale*, that is, a line drawn on the map, divided into equal parts, each part being marked with the distance that it represents on the ground.

(1) To find the number of miles to the inch for any map that has a R. F., divide the denominator of the R. F. by 63,360; thus, if R. F. is 1/80,000, then 80,000/63,360=1.263 miles to the inch.

(2) To find the number of inches to the mile divide 63,360 by the denominator of the R. F.; thus, if R. F. is 1/80,000, then 63,360/80,000=0.792 inch to the mile.

(3) To construct a graphical scale to read yards being given the R. F. If the R. F. is 1/21,120, 1 inch on the map will represent 21,120/36=586.66 yards on the ground. If a scale about 6 inches long is desired; 6 inches on the map will represent 6×586.66=3,519.96 yards on the ground; so that the scale should represent 3,500 yards. The number of inches to repre-

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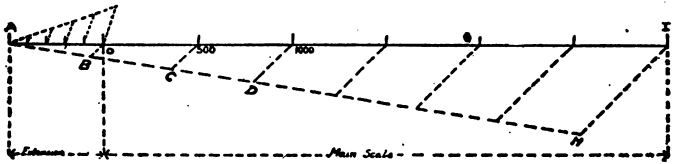
sent 3,500 yards is then 3,500/586.66=5.96. Lay off with a scale of equal parts the distance AI=5.96 inches (about 5 and 9½



tenths), and divide it into 7 equal parts by the construction shown in the figure, as follows: draw a line AH, making any convenient angle with AI, and lay off 7 equal convenient lengths (AB, BC, CD, etc.), so as to bring H about opposite to I. Join H and I and draw the intermediate lines through B, C, etc., parallel to HI. These lines divide AI into 7 equal parts, each 500 yards long. The left part, called the extension, is similarly divided into 5 equal parts, each representing 100 yards.

See working scales on plates I and II at end of book.

(4) To construct a scale for a map on which there is no scale indicated. Measure the distance between any two definite points on the ground represented, by pacing or otherwise, and scale off the corresponding map distance. Then see how the distance thus measured corresponds with the distance on the map between the two points. Suppose the distance on the ground between two points is 1 mile, and that the corresponding map distance is 3/4 inch. Then 3/4 inch on the map = 1 mile on the ground; and 1 inch on the map = 4/3 or 1⅓ miles on the ground. The R. F. is then $1/1\frac{1}{3} \times 63{,}360 = 1/84{,}480$. The scale of yards can then be constructed as above (3).

(5) To construct a graphical scale from a scale expressed in unfamiliar units, such as the meter (39.37 inches), strides of

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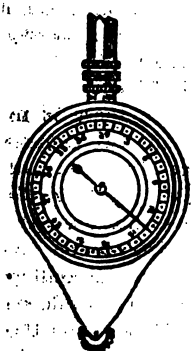
a man or horse, rate of travel of a column, etc. Suppose that the scale found on the map was 1 inch = 100 strides, and the stride was 60 inches long; then 1 inch on the map = 6,000 inches on the ground and the R. F. is 1/6,000. A graphical scale can then be constructed as in (3).

207. *Scaling distance from a map.*—There are four methods:

(1) Apply a piece of straight-edged paper to the distance between any two points and mark the distance on the paper. Then apply the paper to the graphical scale and read the number of units indicated. Or copy the graphical scale on the edge of the paper and apply directly to the map.

(2) Take the distance off with a pair of dividers, and apply the dividers thus set to the graphical scale.

(3) Use a map measurer. Set the hand to read zero; roll the small wheel over the distance; then roll the wheel in an opposite direction along the graphical scale, noting the number of units passed over. Or, having rolled over the distance, note the number of inches on the dial and multiply this by the number of miles or other units per inch.



(4) Apply a scale of inches to the distance to be measured, and multiply this distance by the number of miles per inch shown by the map.

208. Differences of elevation are represented by *contours* or by *hachures;* with each method the heights of prominent points are usually indicated by numerals on the map.

(1) *Contours* are lines drawn on the map which represent points on the ground of equal elevation. They are the projec-

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tion on the map of lines cut on the ground by imaginary horizontal planes that are the same distance apart. The horizontal distance on the ground between two contours is called the *horizontal equivalent* (H. E.). The distance between two contours on the map is called the *map distance* (M. D.). The *contour interval* (V. I.) is the vertical distance between successive imaginary planes. In order that the M. D. may be constant for a given slope, the contour interval must vary with the scale of the map, and is prescribed for military maps in par. 34, F. S. R.

Since the M. D. varies with the slope of the ground represented, it can be calculated for different degrees of slope, and a scale of M. D.'s constructed with which slopes can be read off from the distance apart of any particular contours. This is based on the fact that 57.3 feet (688 inches) horizontally on a 1° slope gives a rise of 1 foot. The formula to be used is: M. D. (inches) = R. F. × V. I. (feet) × 688/ the slope in degrees. A scale of M. D.'s is shown on plate II.

(2) *Hachures* are short parallel or slightly divergent lines running in the direction of the steepest slope. They are seldom used in our maps, but are found on some German maps. The slopes are roughly indicated by varying the blackness and nearness of the hachures. The darker the section, the steeper the slope; where no hachures are found on a hachured map, the ground is either a hilltop or flat lowland.

209. Slopes are usually given in one of three ways: In *degrees*, in *percentage*, in *gradients*.

(1) A 1-degree slope means that the angle between the horizontal and the given line is 1 degree (1°).

(2) A slope is said to be 1, 2, 3, etc., per cent when 100 units horizontally correspond to rises of 1, 2, 3, etc., of the same units vertically.

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(3) A slope is said to be one on one (1/1), two on three (2/3), etc., when one vertical corresponds to one horizontal, two vertical to three horizontal units, etc. The numerator refers to the vertical units.

210. An approximate rule for expressing in gradients a slope given in degrees is to divide the number of degrees by 60. Thus a slope of 5° is equivalent to 1/12. This rule does not hold for steep slopes, but is approximately correct up to 20°.

211. Slopes may be uniform, convex, or concave. Generally, if the slope between two points is convex they are not visible from each other; if the slope is concave they are visible. On a uniform slope contours are equal distances apart; on a steep slope they are near together; on a flat slope they are far apart; on a convex slope they are far apart at the top and close together at the bottom of the slope; on a concave slope the reverse is true.

212. The practicability of different slopes is given in par. 10, Appendix 7, F. S. R.

213. *Directions on maps.*—Having given the means for determining horizontal distances and relative elevations represented on a map, the next step is to determine horizontal directions. The direction line from which other directions are measured is usually the true north and south line (*true meridian*), or the plane of the magnetic needle (*magnetic meridian*). These do not usually coincide. The angle between them is called the *magnetic declination* and is usually given as (*so many*) ° *east* (*west*). It is important to know this angle, because maps usually show the true meridian, and an observer usually has a magnetic compass.

For table of magnetic declinations at various localities see Appendix.

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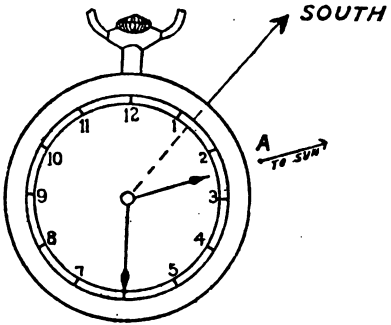
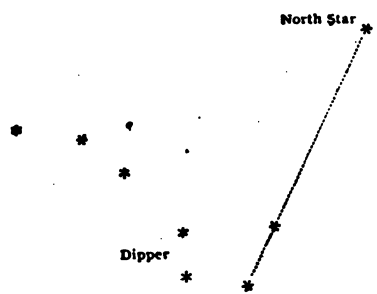
(1) The position of the true meridian may be found as follows: Point the hour hand of a watch toward the sun; the line joining the pivot and the point midway between the hour hand and the XII on the dial will point toward the south. To point the hour hand exactly at the sun, stick a pin as at A and bring the hour hand into its shadow.



(2) At night a line drawn toward the north star from the observer's position is approximately a true meridian. The line joining the pointers of the dipper, prolonged about six times its length, passes nearly through the north star, which can be recognized by its brilliancy. (See E. F. M., Part I, par. 22.)



214. *Orienting a map.*—In order that directions on the map and on the ground shall coincide, it is necessary for the map to be oriented; that is, the true meridian of the map must lie in the true meridian through the observer's position on the ground. Every road, stream, or other feature on the map will then be parallel to its true position on the ground,

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and all objects shown on the map can be identified and picked out on the ground.

To orient the map:

(1) *With compass.*—If the magnetic meridian is shown on the map, lay the compass over it (produced if necessary) and, without distrubing the compass, turn the map slowly round until the north end of the north point on the map is exactly under the north end of the needle. If the true meridian only is shown and you know the local magnetic declination, plot the magnetic meridian on the map with a protractor and proceed as before. If you have no protractor lay the compass on the true meridian and turn the map until this line makes, with the needle, an angle equal to the magnetic declination and on the correct side of it.

(2) *By objects.*—A map can be oriented by an object on the ground without using the magnetic compass.

(*a*) Identify the spot where you stand as some point marked on the map. Also identify on the map some distant object you can see. Join these two on the map by a straight line. Then turn the map about the point marking your position till this line points to the distant object.

(*b*) When you do not know your position place yourself between or in prolongation of a line joining any two points which can be identified. Revolve the map until the line joining the two points on the map points to the two places on the ground.

A map can be set roughly for reading by identifying on the map several prominent objects that can be seen. The map is then held so that the directions between these objects as they appear on the ground and on the map are parallel to each other.

215. *To locate one's position on a map.*—(1) When the map is oriented by compass sight along a ruler at an object on the ground while keeping the ruler on the position of this object on the map and draw a line toward your body. Do the same with

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respect to a second point visible on the ground and shown on the map. The intersection of these two points is your map position.

(2) When the map is oriented by an object sight at some object not in the line used for orientation, keeping the ruler on the plotted position of this object and draw a line until it cuts the direction line used for orienting the map. This is your position on the map. Any straight line on the map such as a road is useful for orienting and thus finding your position. Usually your position may be found by characteristic landmarks, as crossroads, a railroad crossing, a junction of streams, etc.

216. *Conventional signs.*—These are given in Appendix 4, F. S. R.; Eng. F. M., part 1; and in the manual of Conventional Signs, U. S. Army Maps. They should be thoroughly learned so that their meaning will be known at a glance.

217. *Using maps in the field.*—(1) Observe the scale, see if it is in familiar units and how many inches equal 1 mile, so that you can make rapid mental estimates of the distance between prominent points shown. Get the scale relation firmly fixed in mind for the map under consideration.

(2) Learn the contour interval from the numbering on the contours or by observing the number of contour intervals between two known elevations, usually marked on hilltops or crossroads. This will give you a clear idea of the relative height of hills and depressions of streams, and will tell you which are commanding positions, good view points, etc.

(3) Observe the position of the true and magnetic meridians and the number of degrees of declination.

(4) Pick out the streams on the ground and map and trace them by eye throughout their visibility. This is a most necessary step in acquiring a good general knowledge of the ground and map, because the streams form the framework of the area upon which the contours are based.

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(5) Next pick out the tops of all hills and trace the highest lines of all the ridges.

(6) Next construct (if not given) a scale of M. Ds. for the map and learn the general character of the slopes of the ground. See where the flattest and steepest parts occur and the approximately greatest angle of slope, also where troops can maneuver.

(7) Pick out all towns and villages, noting their names, sizes, etc.

(8) Trace all roads and railroads and get a good idea which are the main roads and which only field tracks.

(9) Next take up the particular points to be investigated and study the map with these in view. For instance, where are good defensive positions, camp sites, lines of observation, good roads with easy grades for the passage of trains, etc.

MILITARY SKETCHING.

(Par. 34, F. S. R.; Part I, E. F. M.; Rapid Reconnaissance Sketching, Sherrill.)

218. *Equipment.*—The Engineer Department issues a standard reconnaissance equipment based solely on the plane-table method. The outfit is divided into equipment, which is permanent, and supplies, which are expendable. The complete outfit is:

EQUIPMENT.

1 alidade.	1 holder, timing pad.
1 board, sketching.	1 pace tally.
1 chest, sketching outfit.	1 pencil, pocket.
1 clinometer, service, with case.	1 tripod, wood, folding.

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SUPPLIES.

12 celluloid sheets.	6 pencils, drawing, H.
2 erasers, rubber.	2 pencils, green.
6 pads, timing.	2 pencils, red.
72 paper sketching board sheets.	2 protectors, pencil point.
2 pencils, blue.	2 tape, adhesive, rolls.

One outfit is issued to each regimental and battalion headquarters of infantry, cavalry, and field artillery, and three to each engineer tool wagon, giving six per company or three per mounted company. Headquarters of higher engineer units, and of division and chief engineers not attached to engineer units, receive normally three such outfits, but division and chief engineers may receive a larger number if they so requisition.

The alidade is a triangular scale, $10\frac{3}{16}$ inches long, weighted at the ends, is conveniently graduated and has blank spaces for pasting on individual scales of paces, walk, trot, and gallop.

The board has a compass needle 3 inches long and quite sensitive. At each corner is a clip to hold the paper firmly in place. No plumb bob is provided, but a hole is accurately bored so that a plumb bob can be improvised and use made of the slope scale on the board in case the clinometer should be lost. The plate on the back of the board is let in flush so that the board can be turned freely on the tripod for orientation and then firmly clamped by a slight turn of the tripod screw. As the tripod is not ordinarily used in mounted sketching, holes have been bored at the corners of the board for the insertion of a carrying cord if desired.

The tripod is of wood with telescoping legs, which fold to 15 inches or extend to about 40 inches and detach from the top for packing in the container. The top, also of wood, is provided

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with a heavy thumbscrew for attaching the board, and is covered with felt to give a firm bearing without sticking or binding.

The celluloid sheets are for use instead of sketching paper during rainy weather.

219. *Scales.*—These are prescribed in par. 34, F. S. R., and are for *position and outpost sketches*, 6 inches=1 mile, V. I. 10 feet; *road sketches*, 3 inches=1 mile, V. I. 20 feet; extended operations, 1 inch=1 mile, V. I. 60 feet. *Place sketches* should be made on the 6-inch scale, with 10-foot contours, unless they join or extend road sketches, in which case they are made on the 3-inch scale with 20-foot contours. The use of this system enables one scale of map distances to be used, and a given M. D. between contours always represents the same slope, no matter which of the scales is used. The sketcher should learn the M. D. corresponding to one, three, five, and seven degrees of slope, so that he can plot them accurately from memory; he can then draw contours rapidly to show slopes from 1° to 14°. For example, ½° slope is represented by two lengths of the 1° distance; 2° by one-half the 1° distance; 3½° by twice the 7° distance, etc. This ability to convert ground slopes immediately to map distances is the key to rapid contouring. Scales of yards, paces, time, and M. D.'s are shown on Plates I and II.

220. *Measurements made in military sketching.*—The measurements required are for distance, horizontal direction, slope, and elevation.

(1) *The methods of distance measurement.*—The units used are the sketcher's stride in inches; the distance in inches passed over by the sketcher's horse per minute at a trot, and at a walk; the distance in inches passed over by one revolution of a wheel; 100 yards as estimated by a skilled sketcher.

(*a*) *The stride* (2 paces) is the unit ordinarily used for position and outpost sketching for the controlling measurements.

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The sketcher should determine the length of his stride by pacing at least twice an accurately measured course from one-half to 2 miles long, over ground of varying slopes, keeping a record of the number of strides with a pace tally, held in the left hand, and pressed each time the right foot comes to the ground. The average number of strides for the course is thus determined, and from this the length in inches of the stride determined, and a scale of strides at 6 inches=1 mile constructed. For example, if the length of one stride is 57.6 inches: R. F.=1/10,560 or 1 inch=10,560/57.6 strides=1 inch/183.33 strides, or 5.45 inches=1,000 strides, from which a working scale is constructed as explained in paragraph 255.

(*b*) *Horse's walk and trot* is the unit ordinarily used for road sketching. The horse's rate should be determined by riding him several times over an accurately measured course at a walk and at a trot. Care must be taken not to rate the horse faster than he can travel for a day's work. If a sketch must be made on an unrated horse when no time is available for rating, the sketcher should use the scale of average walk and trot, a mile in 16 minutes at a walk, and in 8 minutes at a trot. Having determined the rate of the horse, a scale of minutes, halves, and quarters should be constructed. For example, if the horse trots 1 mile in 8 minutes, and the R. F. is 1/21,120, 8 minutes=63,360 inches; 1 inch=8/63,360 minutes; 21,120 inches=21,120×8/63,360=8/3=$2\frac{2}{3}$ minutes. Since 1 inch on the map=21,120 inches on the ground, 1 inch on the map=$2\frac{2}{3}$ minutes on the ground; and 6 inches on the map=6×$2\frac{2}{3}$=16 minutes on the ground. Construct the scale by dividing the 6-inch line into 16 equal parts for minutes, and the left one of these spaces into 4 equal parts to read quarters of a minute.

(*c*) *Rule for correcting scales.*—Scales of strides and of the walk and trot should be tested in actual sketching and corrected

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if necessary. A sketch smaller than intended (scale too small) is caused by having assumed the horse's gait to be slower or the stride shorter than it actually is.

(*d*) *The distance passed over by a revolution of a wheel.*—This method of determining distance is of great value in making road sketches, especially in combined work, because of the uniformity secured. The length covered per revolution is best determined by driving over a measured course and dividing the length of the course by the number of revolutions. The number of revolutions is recorded by an odometer attached to the axle of a front wheel; or a piece of white cloth may be tied around the tire and the rotations of the wheel recorded on a pace tally. If no measured course is available over which to determine the length of one revolution, the circumference of the wheel is found by multiplying the diameter by 3.1416.

(*e*) *Estimation of distances.*—An essential qualification for a rapid and accurate sketcher is the ability to estimate distances with less than 10 per cent error up to 600 yards, and within 15 per cent error up to a mile. This can be acquired by constant practice in making estimates of various distances and then verifying the estimates by accurate measurement. Estimates of distance should be made in yards, and 100 yards should be definitely fixed in mind as a reference unit. In all estimation of distance the sketcher should bear in mind the effect of conditions of ground and light on estimates.

Objects appear nearer than they really are:

(*a*) When the sun is behind the observer and the object is in the bright light.

(*b*) When seen over a body of water, snow, or level plain.

(*c*) When below the observer.

(*d*) When in high altitudes and very clear atmosphere.

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In the above cases add to the normal estimate.

Objects seem farther away than they really are:

(*a*) When up a steep hill from the observer.

(*b*) In poor light such as fog.

(*c*) When seen across undulating ground.

In the above cases subtract from the normal estimate.

Objects are distinguishable to average eyes at the following distances:

9 to 12 miles, church spires.

5 to 7 miles, windmills.

2 to 2½ miles, chimneys.

2,000 yards, trunks of large trees.

600 yards, individuals of a column.

500 yards, individual panes of glass in windows.

400 yards, arms and legs of dismounted men.

But visual acuity differs and the sketcher should learn for himself at what distances objects can be seen by him and their appearance at different ranges, by noting objects on the ground and scaling their distances from a good map.

Telegraph and telephone poles are usually set at fixed distances along any one line, so that the sketcher, by pacing one interval or by dividing a known distance by the number of poles contained, may secure their distance apart and make accurate measurements as far as the poles are visible.

(*f*) *The estimation of ground distances directly as spaces on the sketch.*—The sketcher should learn to estimate the map space corresponding to a given ground distance. This power is rapidly acquired by using a scale of hundreds of yards as the unit of plotting. The sketcher should plot, by estimation, 100 yards, then test it with his scale and repeat until he can do it with no appreciable error.

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(2) *Method of measuring the horizontal direction of an unknown point from a known point.*—Set up, level, and orient the sketching board. The board is said to be oriented when the compass needle is parallel to the sides of the compass trough. Assume a point a^1 on the paper as the location of the known occupied point (Pl. III) in such a position that the ground to be sketched will fall on the sheet. Pivot the alidade on *a* and sight along it, directing it on the unknown point as B^1; then draw a line along the alidade.

(3) *Method of measuring slope.*—Slopes may be measured with the service clinometer, or by using a plumb bob attached to the sketching board in connection with the slope scale on the board. The ability to estimate correctly the general slope between two points is important for accurate and rapid contouring. This is gained by making a systematic series of estimates of slopes over various kinds of ground, verifying each estimate with a careful clinometer reading.

(4) *Method of measuring elevation.*—The elevation may be found from the slope and the distance by applying to the plotted distance the M. D. corresponding to the slope. Elevations determined in this manner are affected by errors in both slope and distance. If the slope is correct but the distance too great, then the M. D. for the slope is contained too many times in the plotted distance, giving too great an elevation. The ability to estimate accurately differences of elevation is of the greatest value in rapid contouring, because these direct estimates of elevation are found to be more nearly correct than the elevations determined by estimation of slope and distance. Estimates of elevation should be made by determining a horizontal plane

[1] Capital letters refer to actual points on the ground; lower case letters to corresponding points on the sketch.

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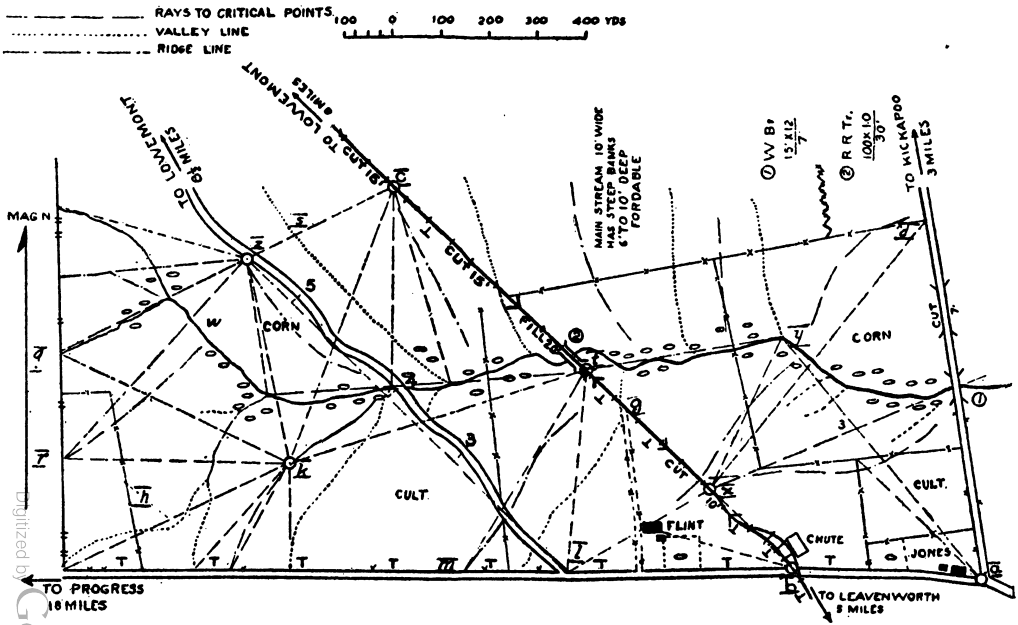
PLATE III.

HORIZONTAL FRAME WORK OF POSITION SKETCH AREA I

Scale - 6 in = 1 mile



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(using the clinometer if necessary) and estimating the elevation of the unknown point above or below this plane by comparison with the heights of objects in the vicinity, such as telegraph poles, trees, etc. The sketcher should learn the height of such objects in the vicinity. By carrying forward with long sights (using the clinometer at zero) points of equal elevation along a traverse, elevations throughout a day's road sketch can be attained with sufficient accuracy.

221. *Military sketches should show:*

All lines of communications: Roads, trails, railroads (with towns to which they lead and railroad stations), rivers, lakes, canals, telegraph and telephone lines.

All objects giving cover or forming obstacles: Woods, tall growths of grain, swamps, unfordable bodies of water, ravines, rugged cliffs, stone walls, fences, hedges, cuts, and fills.

The configuration of the ground: Contours showing all hills in their true location and shape, the character of their slopes and their relative heights, all ravines and slight undulations affording a sheltered line of movement to troops.

All easily distinguished landmarks: Isolated trees of unusual type, such as Lombardy poplars; houses, especially those of stone and those at crossroads; villages and towns to show the general plan of streets and houses.

All military dispositions: Defensive works (trenches, obstacles, etc.); bodies of troops drawn to scale.

The vulnerable points of lines of communication: Bridges, culverts, locks and dams, ferries and fords, with the character of each.

All stores and supplies for men and animals: Water supply, grazing grounds, storehouses of grain, etc.

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A *title*, giving the locality sketched, the date, the sketcher's name, a scale of yards, the R. F., a scale of M. Ds., and the magnetic meridian.

222. *Conventional signs.*—These are given in Appendix 4, F. S. R.; E. F. M., Part I; and in the manual of Conventional Signs, U. S. Army Maps. They are prescribed for military sketches.

223. *Classification of military sketches.*—Military sketches are classified as *individual* or *combined* sketches. An individual sketch is of limited extent, executed by one person. A combined sketch is the result of the simultaneous work of a number of sketchers, so combined as to make a map covering a number of parallel roads (combined road sketch), or an area extending across the front of the command (combined position sketch).

Military sketches are also classified according to their object or the method of their execution as:

(*a*) *Area sketches*, which are of three kinds: *Position*, *outpost*, *place* sketches.

(*b*) *Road sketches.*

A *position sketch* is one of a military position, camp site, etc., made by a sketcher who has access to all parts of the area to be sketched.

An *outpost sketch*, as its name indicates, shows the military features of ground along the friendly outpost line and as far toward the hostile position as may be sketched from the rear of and along the line of observation.

A *place sketch* is one of an area, made by a sketcher from one point of observation. Such a sketch may cover ground in front of an outpost line or it may serve to extend toward the enemy a position or road sketch from the farthest point which can be reached by the sketcher.

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224. *Principal requirements.*—In making a military sketch the principal requirements are *clearness*, *accuracy* sufficient for all military requirements, *simplicity*, and the *completed sketch* in the time available.

225. *Methods of sketching.*—The location of the critical points (points of abrupt change of general slope, of abrupt change of direction of a road, stream junctions, etc.) must first be determined horizontally and vertically.

(1) *The horizontal location of a point* may be determined either by traverse, intersection, resection, offset, or by estimation.

(*a*) The location of an unknown point, as B, with respect to a known point, as A, by *traverse*. The sketching board is set up at A (Pl. III) and leveled as accurately as possible by eye, the board oriented, and the horizontal direction of the point B determined as stated in par. 269 (2). This is called orientation with the needle. Move to B determining the distance by one of the methods given in par. 269 (1). With the scale lay off this distance from *a* and mark the point *b*. Other points as C, F, etc., would be located in the same manner.

(*b*) The location of an unknown point, as K, with respect to two known and plotted points, as T and C (Pl. III), by *intersection*. Set up, level, and orient sketching board at T, by laying the alidade along the line *t c* and rotating the board horizontally until the alidade points exactly toward C. This is called orientation by back sight. Pivot the alidade on *t*, sight and draw a line toward K. Now move to C and repeat the operation. The intersection of the two lines locates K on the sheet at *k*.

(*c*) The location of a point by *resection*. First method: Having given a direction line as *c q* (Pl. III), on which lies

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the desired point, and a plotted point, as *k*, outside of that line; to determine the position on the sketch of any point on the line CQ, as Z: set up and level the board at Z, then orient by laying the alidade on *c q* and rotating the board until the alidade points at C. Clamp the board in this position. Pivot alidade about a pin stuck at *k* and sight K. Draw a line along the alidade and its intersection with the line *c q* locates Z on the sketch as *z*.

Second method: Having given two plotted points, as *t* and *c* (Pl. III), to determine the position on the sketch, *k*, of a point K on the ground. Set up, and level the table at K, orienting with the needle. Clamp the board. Pivot the alidade on *t*, at the same time sighting T, and draw a line along the alidade toward the body at the estimated position of *k*. Similarly, pivot the alidade on *c* sighting C, drawing a line until it cuts the one from *t* and this point of intersection is the required point *k*. This method is available as soon as two visible points are plotted and finds very frequent use in sketching in details around a point such as K.

(*d*) The location of points by *offset*. This consists in measuring distances perpendicular to the traverse for locating details. For example, a winding road Z L might be located by sighting from Z toward L and drawing the line *z l* (Pl. III). The distance from Z to L is then measured along the line (or along the road itself) and the critical points *3*, *4*, and *5* located by offsets perpendicular to the line.

(2) *Method of finding the elevation of an unknown point D from a known point A* (Pl. III) *and the location of contours on this line:*

(*a*) Measure the slope from A to D with clinometer, or slope board, and the horizontal distance by traversing, intersection, or resection. Plot to scale the distance found and apply the M. D.

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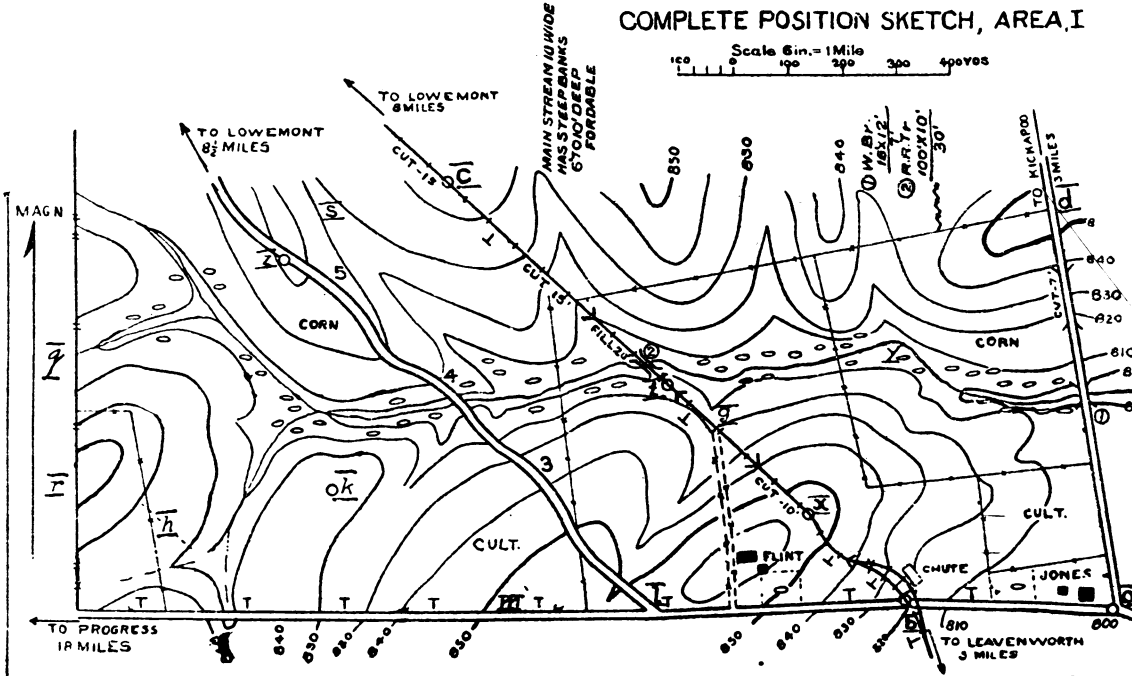
PLATE IV.



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for this slope successively along the plotted length. The number of times the M. D. is applied multiplied by the V. I. equals the difference of elevation between A and D. The number of contours between A and D is also determined, and they should be spaced so as to show the variations of slope as they appear to the sketcher.

(*b*) After acquiring skill in estimating distances, elevations, and slopes, estimate the difference of elevation between A and D (Pl. III), and space the contours by eye. Or the number of contour intervals may be estimated. In this case the number of contours, including the top and bottom ones, is one greater than the number of contour intervals.

(*c*) When a generally uniform slope extends to the limits of the sketch, read the slope with a clinometer or slope board, and with the scale of M. Ds. for the slope locate contours to the limits of the sketch without determining the elevation of any point on the line other than the one known. After skill in estimating is acquired, estimate the slope and plot the contours with the scale of M. Ds. After skill in plotting by estimation of the M. Ds. corresponding to different slopes is acquired, estimate the slope and space the contours by estimation.

226. *Execution of a position sketch* (Pl. IV):

(*a*) Select and traverse a base line.

(*b*) Locate a series of critical points over the area by intersection.

(*c*) Fill in detail in the vicinity of these triangulation points.

(*d*) Fill in detail around other important points located by resection.

(*e*) Fill in all other required details by traverse to all necessary points not visible from the intersection or resection stations.

(*f*) It is important that the sketch have sufficient depth to show lateral communications in rear of line that will probably be

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occupied. Points to which roads to the rear lead should be indicated in margin in writing.

227. *Execution of an outpost sketch.*—An outpost sketch is executed in the same manner as a position sketch except that the sketcher can not advance beyond the line of observation, but must show the ground from one-half to 2 miles in front of this line toward the enemy. Critical points in front of the line of observation must be located by traverse along the base and intersections from stations on the base. The base might be located some distance in rear of the outpost line if necessary to avoid exposure to fire along the line of observation, and from this retired base critical points could be located on the line of observation by intersection or resection. These points can then be occupied to obtain the necessary critical points in front. It is important that the sketch have sufficient depth to show lateral communications in rear of line that will probably be occupied. Points to which roads to the rear lead should be indicated in margin in writing.

228. *Execution of a road sketch.*—A road sketch is normally made mounted on account of the rapidity of work thereby secured. A large part of the work is done by traversing the road and estimating offsets. Intersection locations are not usually required at more than 400 or 500 yards from the road, and no resection work is usually possible. Details should usually be limited to 400 yards from the road, except for prominent positions, etc. All plotting should be done dismounted, but notes should be made on the timing pad of important details passed while mounted and moving between stations. Halts are usually required every three or four minutes. A stop watch is very convenient for this work. An example of a road sketch is shown on plate V.

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229. *Execution of a place sketch.*—A place sketch is made under the supposition that the sketcher is limited to a single point of observation overlooking the area to be sketched. The work is executed in a manner similar to a position sketch except that all control points are located by determining distance with range finder (or by estimation), elevations with clinometer (or by estimation), horizontal directions as described in par. 269 (2). First locate stream lines, next roads, then hilltops, and finally contours and minor details.

The place sketch is made under the same conditions as a perspective sketch, but has the advantage that it represents truly to scale the features of the ground in their relation to each other as estimated by the sketcher, and to be interpreted need not be examined from the point occupied by the sketcher.

230. *Points to be observed in sketching:*

(*a*) Be sure the intersection and resection points are well marked to avoid sighting back on the wrong point.

(*b*) Study the area carefully and do not sight any point that will not help the work.

(*c*) Keep constantly in view the scale of the sketch, the contour interval, and the smallest distance that can be shown.

(*d*) Be sure that the orientations are correct and that the board is clamped after orientation. The forward sight to the next station should be made as soon after orientation as the position of the occupied station is plotted.

(*e*) After the first set-up always orient by back sight if possible.

(*f*) Do not leave a station until all the details up to that point are put in.

(*g*) Try to put equal care and time on all parts of the sketch.

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231. *Combined position sketches* are executed by dividing up the sketchers into groups of two, and assigning to each group an area one-half mile wide by two or more miles deep. A control road or other line is usually selected along one side of the area to be sketched. The groups are deployed along this road at intervals of one-half mile. No. 1 of each group accompanied by No. 2 of the adjacent group sketches a strip of terrain about one-half mile wide along the boundary line between their areas, the required depth of the area. This sketch is then cut apart along the boundary line, and each sketcher takes the part pertaining to his area, and meets the other number of his group at the center of the group area. The two parts of the sketch of the group area are then placed 3 inches apart on a sketching board, and the two sketchers of the group return to the control road along the center of their area, sketching the parts of their area not already sketched. The sketches can then be combined at a designated assembly point.

The vertical control is given by the chief of the sketchers, who determines elevations along the control road with an aneroid barometer.

232. *Combined road sketches* of two or more parallel roads are executed by assigning a party of sketchers to each road. One, the director, marks out the road to be sketched by posting numbered cards of a given color at all road junctions. Another, the principal sketcher, sketches the main road. The remaining members, assistant sketchers, sketch in turn all connecting roads leading to the right to the next parallel road marked by cards of a different color; or, in case of the right party, a fixed distance to the right. They note on the cards when they leave their main road to sketch the cross road, and mark on their sketches the numbers and colors of the cards indicating the road. They then return to their main road and sketch the next con-

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necting road indicated by a card not marked as having been sketched. The sketches of the parallel and connecting roads are combined at a designated assembly point.

The vertical control is given by the director of each party, who marks the elevation obtained with an aneroid barometer upon each card. For a complete description of combined sketching see Individual and Combined Sketching, by Cole and Stuart.

233. *Map reproduction.*—If the sketches are made on tracing paper or celluloid they may be reproduced by blue printing or by lithography. Equipment and supplies for these methods are carried in a wagon assigned to the headquarters of an engineer regiment. If the sketches are made on ordinary paper they must be traced on tracing linen or paper for reproduction. Simple sketches may be gone over with special ink and reproduced with the hectograph equipment carried on the tool wagon of each engineer company.

234. *Map enlargement.*—Maps may be enlarged with a pantograph, carried in the headquarters wagon of an engineer regiment; or by drawing squares of convenient size on the original map, and then drawing on the paper on which the new map is to be made squares whose sides bear the required ratio to the sides of the squares on the original.

OVER-SEA OPERATIONS.

(Pars. 121, 257, 258, F. S. R.)

235. *Over-sea operations* may be undertaken with a view to:

(*a*) The establishment of a base for military operations either against the enemy's field armies or against a coast fortress.

(*b*) The establishment of a naval base.

(*c*) Raids against shipping, communications, etc.

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236. *Combined naval and military operations* may be either offensive, when the Navy assists the Army in the capture of a fortress or locality near the sea, or when the Navy secures and arranges the landing of a force in hostile territory; or defensive, when, for example, the Navy secures the flanks of a position taken up by an army on an isthmus.

237. *The success* of over-sea expeditions demands the *command* of the sea. In making use of this term it is not considered desirable to lay down any precise definition as to when this condition may be considered to have been obtained. It is sufficient to state that the naval situation will be such that the naval authorities are willing to recommend the dispatch of an expedition and that such a decision on their part does not necessarily imply that the maritime communications would be absolutely secure against any interruption.

238. The most important function of the Navy in connection with a combined operation is the preservation of the command of the sea, and whether it is preferable that the principal naval force shall be actually in company with the convoy or be disposed elsewhere is a matter for the decision of the naval authorities having in view the general strategical situation afloat.

239. No standard can be laid down for the strength of the naval escort to the convoy. The only essential is that the escort shall consist of sufficient ships to control the transports while in transit and to provide the necessary boats and personnel for the disembarkation.

240. While paragraph 121, F. S. R., sets forth general rules regarding the division of duties between the Navy and Army, it is to be understood that each service is working for a common object, and will render the other all the assistance that

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lies in its power. The complicated duties of embarking and landing troops and stores can be carried out successfully only so long as perfect harmony and cooperation exist between the naval and military authorities and the staff duties devolving on both services have been carefully organized and adjusted.

NAVAL TERMS USED.

241. When combined naval and military operations take place special duties, involving the use of unfamiliar titles, will devolve on officers of both services. These titles, etc., and the meaning to be attached to them are as follows:

Naval convoy officer: The naval officer in command of the naval escort in an over-sea expedition.

Naval transport officer: The naval officer detailed for duty on board each transport to carry out the orders of the naval convoy commander.

Beach master: A naval officer detailed to take charge of the beach and regulate the arrival, discharging, and departure of all boats.

A tow: The number of boats, barges, or lighters, secured to one another, that can be towed by one steamer.

A trip: The passage of a tow from a transport to the landing place.

Naval expressions and terms with their meaning:

A ship or a boat is divided lengthwise into the *fore part*, or *bows; midships*, or *waist; after part*, or *stern.*

The right side is the *starboard*, the left side the *port*, looking forward.

Forward: Toward the bows.

Aft or abaft: Toward the stern.

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Fore and aft: Lengthways of the vessel.

Thwartship: Across.

Alongside: By the side.

Foc'sle: The fore part of the ship.

Quarter-deck: A portion of the deck reserved for officers.

Accommodation ladder: A ladderway or staircase for entering a boat lying alongside a ship and vice versa.

Gangway: A passageway.

Sea ladder: The ladder used when the accommodation ladder is not rigged.

Gunwale: The top of the sides of a boat.

Freeboard: The distance between the water and the gunwale.

Lanyard: A short piece of cord for tying on a knife, oar, etc.

Thwarts: Seats for rowers in a boat.

Stretchers: Rests for the feet of the rowers.

Stern sheets: The space between the after thwart and the stern fitted with seats for passengers and the steersman.

Halliards, stays, guys: Names for different ropes. Halliards are used for hoisting purposes; stays to support mast, etc.; guys for working derricks or other moving spars.

Purchase or tackle: An arrangement of ropes and pulleys for raising or lowering weights.

Fall: The rope of a purchase or tackle.

Cleats: Pieces of wood or metal around which halliards, etc., are secured.

Painter: A rope fastened to the bow of a boat with which to tow or fasten it.

242. *Commands used in handling boats:*

Back starboard: Row backward with the starboard oars.

Belay: Make fast.

Boat your oars: Place all oars inside the boat, blades forward.

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Ease off: Slacken off.

Give way together: Commence rowing, taking the strokes with the stroke oar.

Hansomely: Gently.

In bows: The bow oarsman boats his oar and prepares to use his boathook.

Let fall: Drop the oars into the rowlocks into a horizontal position, blades feathered.

Oars: Cease rowing, keep the oars in a horizontal position, blades feathered.

Up oars: Lift oars to a perpendicular position and keep there.

Ship or unship: Fix or unfix; put in place or take out of place.

Shove off: Push off from the ship's side.

Stand by: Be ready.

Way enough: After this command the rowers take one stroke and then toss and boat their oars.

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CHAPTER IV.

FIELD FORTIFICATION.

(Pars. 133, 184–187, 192–197, 203, 204, and Apps. 2 and 7 F. S. R.; Part V, E. F. M.; App. to E. F. M., 1916.)

GENERAL PRINCIPLES.

243. The object of the use of field fortification by troops in battle is to increase their fighting power by increasing the effect of their fire action and their mobility and decreasing the effect of the fire action of the enemy and his mobility. The power of modern armament requires troops to resort continually to field fortification in both the attack and the defense.

Field fortification decreases losses and increases the offensive power of troops who use it properly; it permits troops to halt in safety under fire and to resume the advance when conditions are more favorable. In order to avoid enormous losses it is absolutely necessary to employ it and to fortify step by step the ground won. It likewise enables troops to hold the enemy with weak forces on one part of the front in order to mass forces and strike him on another part.

LOCATION.

244. No natural or artificial strength of position will of itself compensate for loss of initiative when an enemy has time and liberty to maneuver. The choice of a position and its preparation must be made with a view of economizing the power expended on defense in order that the power of offense may be increased.

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The influence of ground upon the effect of fire must be one of the first considerations in selecting a position. A clear field of fire and ground over which artillery and infantry can act in combination are of great importance, but this importance is relative to the ground over which the enemy must move; thus it is better for the defense to have moderate facilities for the cooperation of infantry and artillery fire and for the attack to have none than for the defense to have good ground, but the attack better. The most favorable ground for the ultimate assumption of the offensive is that which lends itself most to the *cooperation of all arms*, and especially that which allows the advance to be covered by artillery and infantry fire. Ground from which any portion of the front or flanks of a position can be enfiladed is dangerous to the defense.

When it is intended to occupy a defensive position the chief points to be noted are:

(*a*) The best distribution of the infantry and the means of protecting the flanks.

(*b*) The positions for the artillery, which should be posted so as to command:

(1) The positions which the enemy may endeavor to seize in order to develop an effective fire against the position.

(2) The probable positions of the enemy's artillery.

(*c*) Any points the possession of which might exercise a decisive influence on the issue of the fight.

(*d*) The most favorable lines of attack.

(*e*) The most favorable ground for the counter attack.

(*f*) Ground to be occupied by the general reserve and by the cavalry.

(*g*) Positions to be occupied in case of retreat.

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ORGANIZATION OF A POSITION.

245. The organization of a position does not imply the establishment of a continuous firing trench. The terrain in front of a position is best covered by a combination of frontal and flank fire from distinct elements such as trenches, blockhouses, prepared buildings, etc., separated by small intervals; thus economizing in personnel, which is one of the advantages of fortification, and minimizing the effect of the enemy's artillery fire. Each of these elements is occupied by a fixed garrison, which should always be a complete unit, the strength of which, variable according to circumstances, may be as much as a platoon. These elements are not uniformly distributed along the front; their distribution is determined by the features of the terrain, the necessity of having a greater volume of fire at one point than at another, in one direction than another, and other tactical considerations. A line can always be forced at some points so that it is necessary to have elements in rear which come into action when the first have fallen. It is therefore necessary to *disperse* the elements laterally and in depth.

246. A *strong point* is a group of elements, thus disposed, which, by their mutual support, should permit the garrison to hold and stop the enemy by its fire. It should be surrounded by a continuous obstacle. It should always be occupied by a fixed unit responsible for its defense. The strength of this unit depends upon the importance of the strong point; it is generally a company or a subdivision of a company. The strong points should be distributed along the front according to the importance of the portions of the terrain to be held, and the facilities for flanking fire. They will then be grouped together in places, leaving intervals between them, varying in width.

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247. Fire action alone will not always be sufficient for the defense of a position; the defensive position should be organized with a view to the execution of immediate counter attacks for the purpose of recapturing any part of the position that has been taken by the enemy. For this purpose it is necessary to have—

(*a*) Other strong points in rear of those of the firing line.

(*b*) Reserves for the purpose of executing counter attacks.

248. The strong points should be grouped together laterally and in depth. These groups are called *supporting points.* Their defense should be assigned to a tactical unit, usually a battalion or regiment, which will furnish the garrison of the different strong points and the force for the local reserves. Artillery may sometimes be assigned to certain supporting points. The supporting point is generally surrounded by a continuous obstacle. The intervals between supporting points are covered by means adapted to the tactical conditions and the terrain.

249. The combination of several supporting points under one commander forms a *sector.* Each sector furnishes its own reserves distinct from those of the supporting points. It generally has artillery attached.

250. The organization described is called an *intrenched zone;* that nearest the enemy is called the *first intrenched zone.* In rear, there should always be organized a second intrenched zone, and if advisable a third, all similar to the first.

251. The trenches nearest the enemy are called the *firing trenches;* close behind these and connected with them at frequent intervals by *approach trenches* are the *cover trenches,* which are usually continuous within each strong point, and afford easy lateral communication. The combination of these trenches forms the strong points for the firing line.

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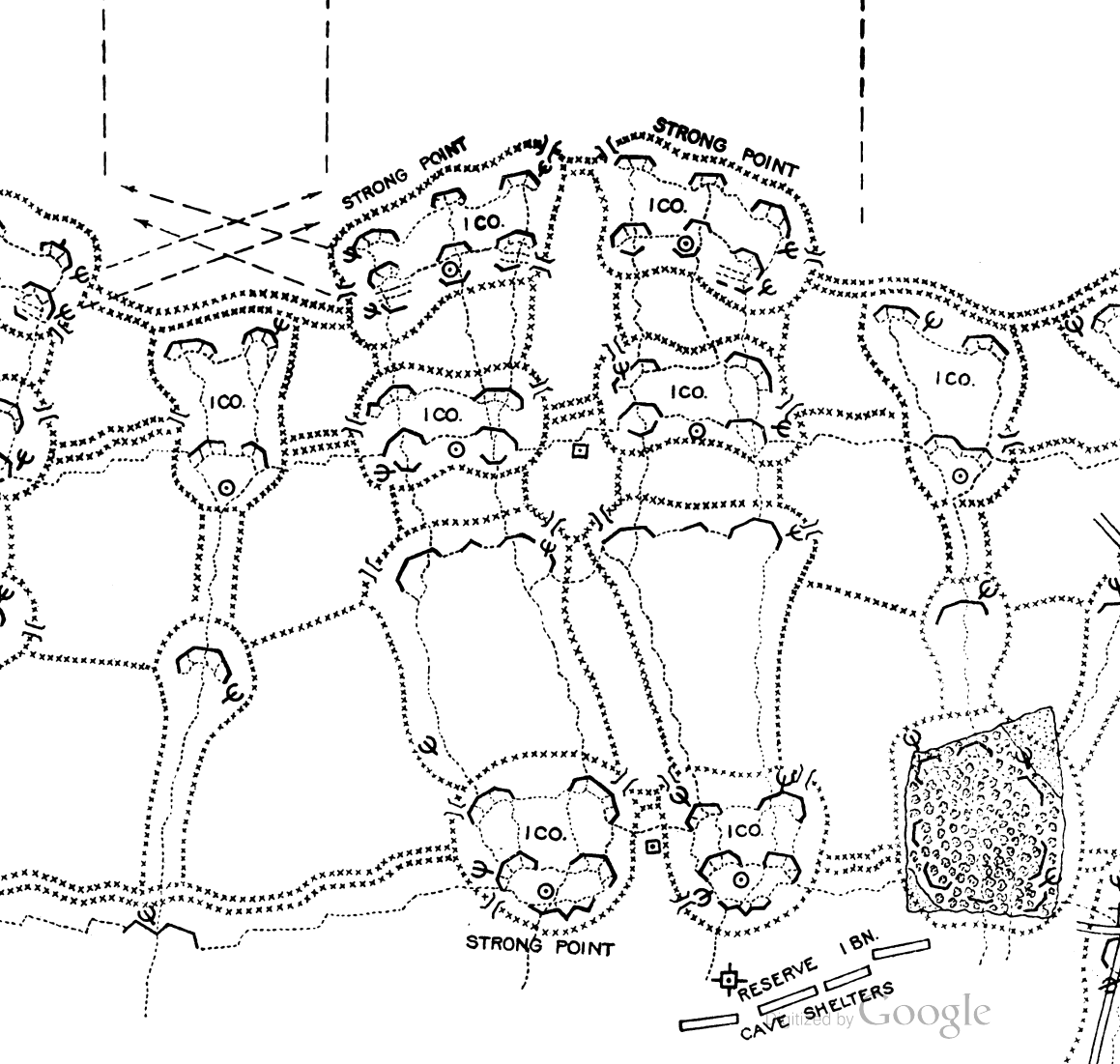

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252. In rear of the strong points of the firing line is a line of strong points made up of firing, cover, and approach trenches and called the *support trenches.* These strong points are usually connected laterally by *communicating trenches,* and with the strong points of the firing line by *approach trenches.*

253. In rear of the support trenches are strong points organized in a manner similar to those in advance, and called *reserve trenches;* these are usually connected laterally by communicating trenches; and with the support trenches by approach trenches. Between the support and the reserve trenches there may be strong points called *intermediate trenches.* The approach and communicating trenches may be prepared for firing at certain points to cover effectively, by frontal and flanking fire, ground not well covered from the strong points.

254. The organization described above is on Plate VI which shows the organization of a brigade front, with three regiments on the line, each with one battalion in reserve in addition to the garrison of the reserve trenches. The organization of a village and woods is shown.

The above organization is a gradual development made during a prolonged occupation of a position in trench warfare such as has developed on the western front in Europe. In the initial occupation of a position the first step would be the construction of the strong points for the firing line, with their firing trenches and obstacles first, then their cover, approach, and communicating trenches. Ordinarily this construction would be all that would be done by hired labor in the preparation of a defensive line not in the presence of the enemy, such as the defensive line for the mobile forces intended for the defense of a seacoast city. The next step would be the construction of the strong points for the support trenches, with the necessary

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communicating and approach trenches. Finally the defensive zone would be completed by the construction of the reserve and intermediate trenches organized into strong points, and all of these into supporting points and sectors.

FIRING TRENCHES.

255. These should usually be constructed in short lengths for a squad, section, or platoon, arranged so that they are mutually supporting and thoroughly cover the ground by both frontal and flanking fire. If longer than required for a squad they should be of an irregular or indented trace and be traversed at intervals of from 5 to 8 yards so as to give protection from enfilade fire and localize the effect of shell bursts.

LOCATION.

256. If the firing trenches are located under fire when an attack has been halted, the location is determined by the line at which the troops are forced to halt and dig themselves in. This line may in some cases be a hostile trench captured in the course of the attack. Ordinarily each man will construct individual cover in the form of a lying trench, which he will gradually improve to a sitting, kneeling, or standing trench. Small adjustments of position may be made by the officers with a view to getting the best possible line under the circumstances. The individual pits will be connected up into squad or longer lengths when night falls, and the trace and location can then be rectified.

257. If the enemy has been found in a strong defensive position and an attack has not been made, or has resulted in a withdrawal, a line of firing trenches may be located under cover of night from 500 to 600 yards, or even more from the enemy,

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the exact distance depending upon the ground, the facilities for natural cover, and the tactical condition. This line may be made fairly strong and complete before any further advance is attempted. Then under cover of darkness or fog, or a heavy bombardment, a new firing trench may be constructed at a distance of 200 to 300 yards from the enemy.

258. When not in the presence of the enemy a careful reconnaissance should first be made and the firing trenches can then be located with due regard to the terrain, the tactical requirements, and economy of men.

259. The following general rules should govern the location of the firing trenches:

(1) The field of fire should be such as to expose an attacking enemy to fire for at least the last 200 to 300 yards of his advance. To insure this it may be necessary to clear the foreground. With well-trained troops a shorter field of fire may be sufficient, provided it is covered by frontal and flanking fire and is strengthened by a good obstacle, which should be well screened from the distant view of the enemy.

(2) Concealment of the trenches is of the greatest importance.

(3) The defenders should be screened from the enemy's view and sheltered from his fire by natural or artificial cover so arranged as to afford the maximum development of rifle fire.

(4) The foreground should contain natural obstacles to break up the formations of attacking troops, but not afford them cover.

(5) There should be good communications within the position and over ground that may be used for counter attacks.

(6) The trenches should not be placed too near unalterable features that reveal their location or furnish good range marks for the enemy.

(7) The location of firing trenches on the crest or forward slope, though exposing them to view and bombardment, gives a feeling

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of superiority to the troops and increases their morale; enables the support, reserve, communicating, and approach trenches to be well concealed; offers greater facilities for observation and for the assembly of troops for the assault close to the firing trenches and unobserved.

(8) The location of firing trenches behind the crest of a slight ridge screens them from view and fire of the enemy's artillery, unless he has in his possession high ground giving a view of the reverse slope. Special conditions, such as the enemy's local superiority in artillery, may justify the deliberate choice of such a position, but it must not be too far down the reverse slope, arrangements must be made to deny the enemy access to the crest of the ridge, and there must be a number of saps forward to the crest to allow continuous observation of the front slope.

(9) In woods the trenches should be located 10 to 20 yards from the front edge; the natural appearance of the woods should not be changed, but a clear field of fire obtained by cutting some of the brush, small trees, and low branches.

PROFILES.

260. Profiles for firing trenches should satisfy the following conditions:

(1) The trench should be as narrow as possible, yet wide enough to allow of movement behind the line of men manning the parapet. The slopes should be kept as steep as possible. The width at the top is usually from 2½ to 3 feet at first; later, when enlarged for the movement of men along it, 4 to 5 feet.

(2) The height of the parapet should be as small as possible, while great enough to give a clear field of fire. This height should not usually be over 1 foot.

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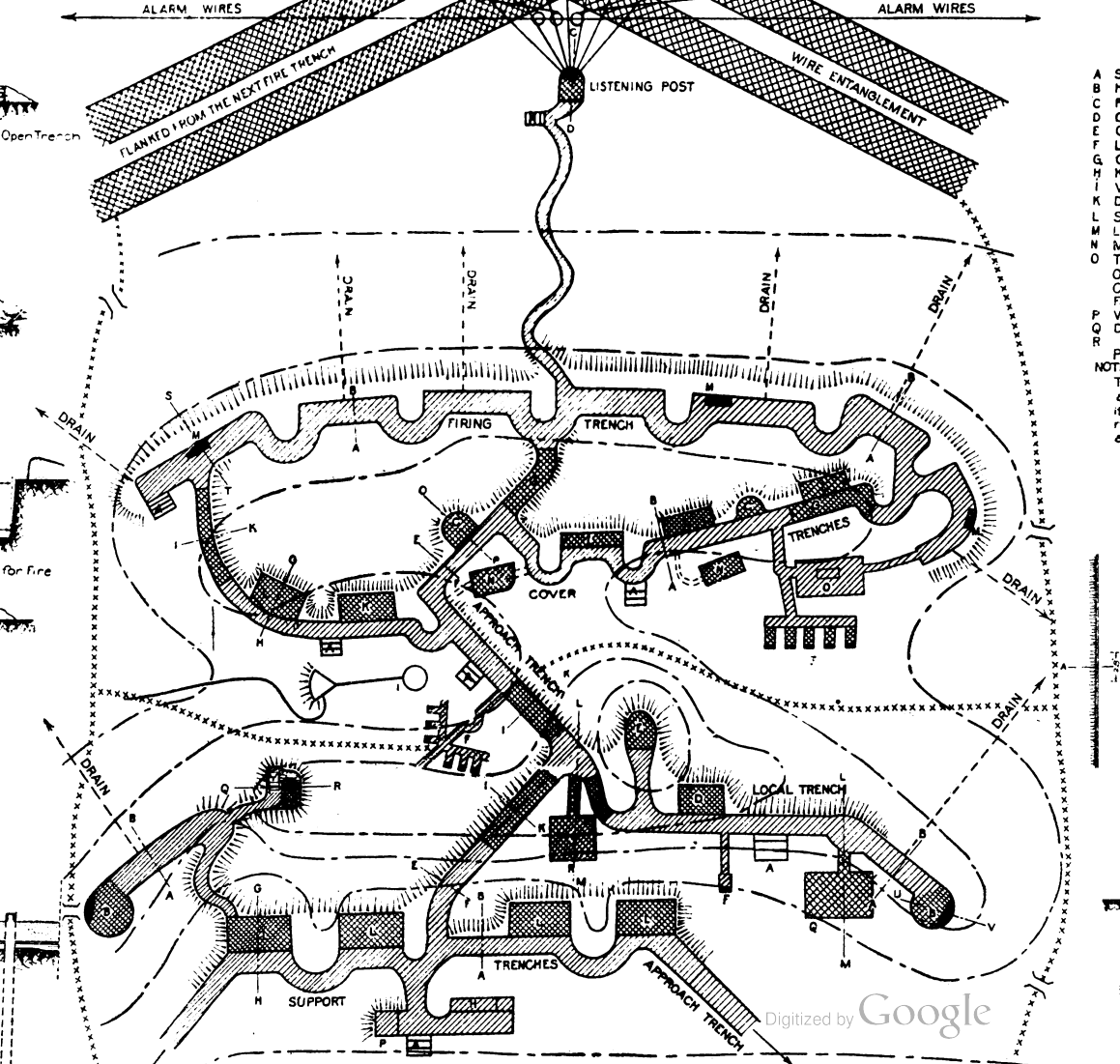
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(3) The parapet must be bullet proof and have a flat front slope. A thickness of 5 feet is usually sufficient. (See table of penetration of the bullet, par. 2, Appendix 7, F. S. R.)

(4) The relief should be such as to permit firing. This requires 1 foot lying down, 3 feet kneeling, and 4½ feet standing. The rear of the trench is deepened later for communication.

(5) There must be a parados to give protection against the back blast of high explosive shells.

(6) A 1-foot berm should be left on both sides of the trench to keep loose earth from falling into it. The front berm serves as an elbow rest.

(7) The profile should be progressive and rapidly executed; it should give protection and permit firing while being constructed.

The profiles shown in Appendix 2, F. S. R., satisfy the above conditions, except that no parados is shown. This should be commenced when the depth for firing kneeling is reached. A profile developed from fig. 4 (Appendix 2, F. S. R.) is shown in section A B, Plate VII.

261. *Cover, approach,* and *communicating* trenches should ordinarily have a width at the top of from 4 to 5 feet and a relief of not less than 7 feet, with a parapet from 1 to 2 feet high. They may be prepared for firing on one or both sides by providing a firing banquette 4½ feet below the crest of the parapet and widening the trench. Profiles are shown in section E F, Plate VII.

262. *Traverses.*—Traverses afford the best method for protection against enfilade fire and to localize the effects of shells bursting in the trench. To be effective against heavy artillery they must be at least 2 yards wide on top and constructed if possible of undisturbed earth. They should be spaced from 5 to 8

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yards apart and should project at least 1 yard beyond the face of the rear wall of the trench. They may be provided with a firing banquette to permit a flank fire along a trench in case part of it is captured. The arrangement of traverses is shown on Plate VII.

For straight-approach trenches the best type is the island traverse, with the trench going around it on both sides. Sections of trench subject to special exposure are sometimes protected with bridge traverses built across the top of the trench (see sec. I K, Pl. VII), or individual niches may be constructed between traverses. Approach trenches are usually protected from enfilade fire by giving them a zigzag trace.

263. *Head cover* is the term applied to any horizontal cover which may be provided above the plane of fire. It is obtained by notching or loopholing the top of the parapet.

(*a*) *Notches.*—When the relief of the trench is too great for a man to fire standing or when the height of the parapet is more than 1 foot above the level of the ground, notches may be made in the parapet. The simplest way to make them and give support to their sides and make them the least visible is to arrange sandbags on top of the parapet.

(*b*) *Loopholes.*—When overhead cover is used loopholes are necessary. They may be constructed of sandbags, wood, steel, hurdles, or other material. (See secs. A B, C D, and O P, Pl. VII.) The sky as a background should be avoided by raising the parados or placing a canvas curtain behind the loophole and closing the opening with a metal cover, which can be removed when the loophole is in use. Loopholes should be concealed by using grass, brush, canvas, or empty sandbags.

In addition to their visibility, loopholes have the disadvantage that they cause a pause in the fire of the defender when the at-

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tack reaches the most deadly zone of fire, because the defenders have to withdraw their rifles to prepare for bayonet fighting. Arrangements should therefore be made for firing over the parapet by constructing banquettes between the loopholes. In all firing trenches, however, a few loopholes are desirable for the use of snipers, and there may be one or two between each two traverses. All night firing should be over the parapet.

264. *Overhead cover.*—The garrison of a trench must have shelter against bombardment by high explosive shells and against the weather. This is secured by shelters, which are classified as splinter proofs or bombproofs according as they are designed to afford protection against splinters of shells bursting over or near them or against shells hitting them direct and bursting on impact.

(*a*) For the garrison of the *firing trench* small shelters may be constructed under the parapet, but the greater part of the garrison should be protected during a bombardment by shelters constructed along the cover trenches. Shelters under the parapet of the firing trench must—

(1) Not interrupt the line of fire.

(2) Be capable of construction after the trench is finished.

(3) Permit the parapet to be manned quickly.

(*b*) In the *cover trenches* there must be a number of shelters so that the garrison which must be kept there in the heaviest bombardment will be completely sheltered. To limit the effect of hits there should be a number of small shelters rather than a few large ones. The maximum capacity should be 25 men. Cave shelters (sec. L M, Pl. VII) may be used if the soil and natural features are favorable for their construction and arrangements can be made to get out of them quickly. Ordinarily the form of shelter shown in section G H, Pl. VII, will be used.

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(c) *In the support and reserve trenches* and in rear, cave shelters and shelters utilizing natural cover, such as quarries and cellars of buildings, may be used. The shelters may also be larger.

(d) *General principles.*—(1) A shelter is valuable only when it offers complete protection and permits the men to get out of it in time. For complete protection it should have a roof strong enough to keep out the heaviest shells. Splinter-proof cover is afforded by a layer of logs or beams 6 or more inches thick covered with not less than 12 inches of earth. Bomb-proof cover against 6-inch high-explosive shells is afforded by a layer of rails or beams, 18 inches of earth, a layer of brick or broken stone, 2½ feet of earth, another layer of brick or stone 6 to 12 inches thick, and over all 6 inches of earth. Cave shelters may be as much as 30 feet under undisturbed earth.

(2) To enable men to get out in time there must be a lookout, placed to one side of the entrance in a protected niche in the parapet, and provided with means to give the alarm. The exit may also be held under fire of an arrangement known as a traverse block house, built of rails and concrete. Certain shelters may also be provided with long periscopes to be placed in the ventilating hole of the shelter.

(3) A burster layer of 6 to 12 inches of brick or stone should always be provided near the top surface of the roof. Over this burster layer should be a layer of not less than 6 inches nor more than 12 inches of earth to decrease danger from the scattering of the brick or stone by the burst of the shell.

(4) The water tightness of the roof is secured by placing over the layer of logs roofing paper, corrugated iron, tin, canvas, tiles, etc.

(5) Drainage should be secured by sloping the floor of the shelter toward a drainage pit constructed near the entrance.

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(6) Ventilation should be provided by holes which may be drilled with an earth auger, near one of the walls of the shelter.

(7) Protection against asphyxiating gas is secured by placing two curtains of canvas at the entrance, which should be lowered when the alarm is given. There must always be in the shelter a barrel of solution of hyposulphite of soda, which is sprayed into the air.

(8) The walls of deep shelters should be strongly revetted to prevent their caving in. Tools should be stored in them so that the men can dig out if the exit is blocked by a shell burst. An earth auger enables a hole to be bored rapidly, through which food, water, and air may be obtained quickly. Cover-shelters should always be provided with two entrances. Food, water, ammunition, grenades, and rockets to warn the lines in rear should be stored in the shelters.

(9) Arrangements should be made for heating and drying the shelters with stoves.

265. *Revetments.*—The deep, narrow trenches, with steep walls now used require careful revetment, especially where the soil does not weather well. To keep the men comfortable and the trenches clean and free from mud requires a substantial revetment. Some soils are apparently firm and stand at a steep slope when first excavated, but under the action of the weather the side walls soon slough off, obstruct the trenches, and make them muddy in rainy weather. In case of long-continued occupancy of the trenches, timber and plank revetment will gradually replace the lighter forms. The trench walls, the seats, benches, and steps in soft ground, especially if they are likely to be much used, should be revetted. If possible this should be done when the trenches are first constructed.

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When of planks or boards, they should be placed on top of one another, behind stakes, and backed up with earth. The stakes should be driven in at the foot of the slope at the desired inclination and at intervals of from 1 to 2 yards. Every second or third stake should be anchored to stakes under the parapet by means of wire, withes, or rope, fastened at about two-thirds of the height of the revetment.

When of branches or brush, the branches or brush is heaped up, like the boards, behind the stakes and sufficiently pressed together to keep the earth at the back from filtering through. If it is not desirable or possible to anchor the stakes separately, a pole can be fastened along them near the top, and this can be anchored at intervals of from 4 to 6 feet.

When of woven brush the pickets are driven at intervals of from 1 to 1½ feet; they are temporarily joined together at the top with a pole. The wattles are alternately passed in front and behind the pickets and interwoven. The pickets should be anchored.

When of hurdles, they are placed close together and the sharpened stakes driven into the ground and anchored. Hurdles are especially suitable for use after a work is finished to strengthen it.

When of sod, the sod should be cut to a size of 18 by 9 by 4 inches. They are laid grass down like brick masonry. If bricks are used, the method of laying them is the same.

When of fragments of hard earth, stones, or sand bags, the method of construction is the same as for sod or brick.

When of expanded metal, it should be supported by stakes about 2½ inches in diameter, at intervals of about 18 inches; the stakes should be anchored, and the metal fastened to them with staples. Rabbit wire or poultry wire netting may be used in the same way.

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Fascines are generally used for making steps; they may also be used for wide trenches.

Gabions may be used for very wide trenches, such as assembly points. They are placed side by side.

266. *Steps.*—Trenches must be provided with means to permit troops to leave them rapidly to make an attack. Steps should be revetted with one or more rows of fascines. Ladders have the advantage of not widening the trench. They are placed vertically against the front wall of the trench. Ramps parallel to the firing trench may be constructed at the ends of the branches of a zigzag communicating or approach trench.

267. *Drainage.*—Drainage is essential to the preservation of the trenches and the health and comfort of the troops. In deliberate works it is well to study the drainage question in detail and to construct special ditches of ample capacity before work on the trenches proper is begun. In trenches constructed in the presence of the enemy, drainage pits should be constructed which can be emptied by bailing or pumping. The bottom of the trench should slope toward the back where a shallow ditch may be constructed, sloping to a drainage pit. Where the soil is impermeable an endeavor should be made to reach a permeable layer by boring with an earth auger. In hilly terrain the water may be drained off by pipes placed under the parapet. (See Pl. VII.)

The drainage and flooring of approach and communicating trenches, constantly used, is specially important, and should be considered in their location. A good form of floor grating is in lengths of 6 feet, 18 to 24 inches wide, made of cross pieces of ¾ by 4 inch boards, nailed to two longitudinal pieces of timber about 3 by 4 inches, set on edge. When timber for flooring is not available, drains filled with broken stone should be con-

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structed in the bottom of the trench, which should always be convex. (See sec. E F, Pl. VII.)

268. *Obstacles.*—The object of an obstacle is to check a hostile rush and delay the enemy under the close fire of the defense. An obstacle should be at such distance from the parapet that it is difficult for hostile bombers to crawl up to it and throw bombs into the trench. On the other hand, the obstacle should be under close observation and fire of the defense. If the front edge of the obstacle is 40 yards from the trench, these conditions are fulfilled. If possible the obstacle should be concealed for purposes of surprise and to decrease its liability to injury by artillery fire; it should form no shelter for the enemy. Some form of wire entanglement is ordinarily used. Obstacles are ordinarily placed all around strong and supporting points and often on both sides of approach trenches. Passages through them for counterattacks are usually covered by machine-gun fire. (See Pl. VI.) The quantity of wire required is enormous; for a strong defensive position at least 100 miles of wire to the mile of front must be provided. At important points the wire entanglement is placed in belts 20 feet wide, two or more belts about 20 yards apart being used. The trace of the obstacle should not be parallel to the firing trench, so that it can be flanked by rifle and machine-gun fire and can not be used by the hostile artillery for ranging on the trenches. The modern form is a compromise between the high and the low wire entanglement described in the Eng. F. M., and is generally from 2 to 2½ feet high. The wire is *strung loosely*, and many forms of spirals and hoops have been devised. Barbed wire is ordinarily used; the posts are of wood or iron; the iron ones are provided with eyelets for attaching the wire, and the lower end is auger twisted for about 18 inches so that

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it can be screwed securely into the ground at night without noise, a great advantage when in close proximity to the enemy. There are usually three rows of posts set in quincunx order from 6 to 8 feet apart.

When the lines are too close to permit the placing of posts portable obstacles in the nature of chevaux de frise, triangular pyramids of timber thoroughly wired, or timber or steel frames and sawbucks wired, are thrown out in front of the trenches.

269. *Concealment.*—The trenches and other works should be made as nearly invisible as possible, and their concealment should be completed by treating the front slope of the parapet so that its appearance from the front and from air craft will correspond to that of the surrounding ground. Crops should be replaced where disturbed, and carefully arranged; bushes should be planted to hide the parapet, the men on watch, riflemen, and observers. Sod should be preserved and placed on the parapet and parados.

270. *Dummy trenches.*—Dummy trenches and works should be freely employed so as to deceive the enemy as to the strength of the defender and to scatter his fire. These works should be made slightly more visible than the regular works, so as to attract the attention of the enemy, without causing him to suspect their true nature. Their occupation should also be simulated and the damage caused to them by artillery fire must be repaired, so that the enemy will not discover his mistake.

271. *Observations.*—The observation of the enemy is of first importance in position warfare. It should give complete knowledge of all elements of the hostile line and prompt information of any movement of the enemy. It is effected by observation from the ground and from aircraft.

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Observation from the ground is divided into three echelons:

(*a*) In front of the firing line from small posts and listening posts.

(*b*) On the firing line by sentinels and lookouts.

(*c*) In rear of the firing line, by artillery observers, sentinels, and lookouts of the shelters.

Small posts or listening posts consist of pits, shot holes, organized shell craters, or short trenches for from 1 to 8 men in front of the firing trenches and connected with them by sap or low mine gallery. They should be as nearly invisible as possible and provided with loopholes. Protection at short range from grenades is secured by a network of wire. (See sec. C D, Pl. VII.)

Observation on the firing line is effected by lookout posts organized preferably at the salients where the view is more extended. They are provided with periscopes, range finders, and large-scale maps. They should be concealed by all possible means, as good observation is possible only when done without knowledge of the enemy. The posts should preferably be constructed on the right of a traverse and in an excavation in front of the trench wall. (See sec. O P, Pl. VII.)

The observation posts, even of the infantry, are not necessarily in the firing line or in the listening posts. Often in rear, points will be found which will give an excellent view and will not attract the enemy's attention. The term "observatory" is often employed for observation posts of this kind; they should be protected and have means of communication such as telephone, heliograph, messenger, carrier pigeons, wireless. They may belong to the infantry, the artillery, or higher commands. The observatory may be occupied by the commander himself or by an observer who represents him. In any case the observatory

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should be near the command post (par. 326). It must have a low parapet, be defiladed from view, and proof against large projectiles.

The location of the lookout posts and observatories must be determined in accordance with a complete plan for each supporting point or sector of defense. No part of the hostile front should be free from observation, and parts of the front favorable for an attack by the enemy should be specially watched. An observatory should be located near the command posts of the commanders of strong points, supporting points, and sectors. Those of the last two must have extended views over the whole of the terrain.

272. *Illumination of the battle field.*—In position warfare it is necessary—

(*a*) To discover and keep in touch with the movements of the enemy at night.

(*b*) To seek out and illuminate hostile objectives so as to fire upon them.

(*c*) To blind the enemy.

These results are obtained with searchlights. The smaller ones, about 12 inches, are acetylene and have a short range. The larger, about 24 inches, are electric and have a longer range. They can also be used for signaling. They are placed in shelters, similar to those for machine guns, located so as to flank the line of fire. (See sec. Q R, Pl. VII.) Flares, rockets, etc., are also used.

273. *Lines of information.*—During a bombardment the maintenance of lines of information becomes very difficult, but it must be accomplished by all possible methods, such as:

(*a*) Installing telephones under strong shelters.

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(*b*) Using lead-covered cable, buried 6 feet deep, especially for the lines connecting the regimental, brigade, division, and corps headquarters.

(*c*) Placing rockets in all shelters and observatories where officers or sergeants are posted.

(*d*) Preparing posts for visual signaling, safe from bombardment and defiladed from view of the enemy. These posts are constructed in shelters similar to those for searchlights, and are provided with horizontal loopholes with openings to the flank or rear.

274. *Depots for material and ammunition.*—These consist of galleries of variable dimensions, opened in the walls of the trenches, and usually lined with timber. The entrance should be closed with a strong door. They are used to store water, rations, ammunition, grenades, pioneer tools, portable searchlights, field glasses, maps, range finders, periscopes, lighting pistols, and rockets. Depots for engineer material are usually installed in the angles of the approach trenches. Depots for water, rations, tools, and sand bags are usually established about 20 yards to the right of the company command post. Depots for arms, ammunition, bombs, grenades, and rockets are about 20 yards to the left of the same post. (See par. 326.) An inventory of material should be kept up to date at the company command post.

275. *Machine guns.*—The general principles of their employment are:

(*a*) The personnel and material should be protected from fire as much as possible.

(*b*) In order that they may be available at the moment of attack, it is indispensable that they survive the bombardment. Their protection must therefore be specially provided for by employing all of the following means:

(1) Placing them under shelter.

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(2) Making their emplacements invisible.

(3) Dispersing them laterally and in depth by arranging them in echelon.

(*c*) Casemates must be used only when they can not be seen by the enemy, such as on the reverse slope, or in woods, or in villages. (See sec. U V, Pl. VII.)

(*d*) The great importance of making them invisible necessitates the construction of firing emplacements outside the shelters, but close enough to enable the guns to be put into action with the least possible delay.

(*e*) The firing emplacement may be protected by a light roof with very small height (see sec. S T, Pl. VII), or it may be entirely without overhead protection. The emplacement may consist simply of a pit in the open field, situated in front or in rear of the firing trench, and connected with the shelter by an underground passage. The machine gun should be placed in action at the last moment; it may be simply placed on the edge of the pit without any protection, or preferably it should be covered by a light shield, or a low parapet carefully blended with the natural slope of the ground. The pit should be carefully hidden so that it can not be discovered by the enemy. Emplacements of this nature are frequently employed in rear of the firing line.

(*f*) When the firing trench is situated on the reverse slope, machine guns should be emplaced in concealed pits in front of the trench, on the crest if practicable, and connected with the trench by underground passages.

(*g*) The requirement of concealment makes it necessary to conceal all the approaches to the firing emplacements by making them underground, and to increase the number of emplacements so that it will not be necessary to fire daily from those to be used in case of an attack.

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(*h*) The emplacement of too many machine guns in the firing line is dangerous; in order to stop an attack they should be echeloned to the rear. In favorable terrain, flank fire should be provided, to mow down the attacking lines as they push forward. Therefore, the available machine guns should be distributed between the firing trench and the terrain in rear, with each emplacement prepared in a manner suitable to the terrain and the tactical requirement. (See Pl. VI.)

276. *Trench weapons.*—In trench warfare, batteries of light mortars and other trench weapons are generally emplaced between the cover and support trenches. (Pl. VII.) They may be with or without overhead cover. When overhead cover is used, alternative emplacements without it should be constructed near by, if practicable. The emplacements should be concealed as much as possible, and their parapets should not be higher than those of the adjacent trenches. The guns should be dispersed laterally and in depth as are machine guns.

277. *Command posts.*—Besides their combat positions near the firing trenches each commander of a tactical unit should have an individual rest shelter. Each must have a specific identifying letter or number so that the positions of all headquarters can be definitely known. They must be marked by large signboards and on the map, so that they may form definite reference points. They must be large enough to shelter the commander and his immediate staff and orderlies, and be supplied with the necessary equipment for a field headquarters. (Pl. VII.) Company command posts must have near them the depots for materials mentioned in paragraph 323, so that the troops will always know where to find these materials.

278. *First-aid stations.*—These should be connected with the cover and firing trenches by a communicating or approach trench

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wide enough for a litter to be carried through it. They are constructed like other shelters. The walls should be covered with straw or hurdle work, which must be frequently changed. They should be at least 8 by 12 feet in plan. Two cots should be placed against one wall, and a bench for the wounded to sit on against the other. (Pl. VII.)

279. *Kitchens.*—These should be constructed in shelters. (Pl. II.) The stove pipe should project somewhat above the top of the shelter to secure good draft. In addition, numerous ventilating holes must be made. The shelters should be large enough to accommodate the rolling kitchens. Small fires built of dry wood in the bottom of deep trenches do not betray their position.

280. *Latrines.*—These should be constructed in the vicinity of all trenches. They may be covered or open (Pl. VII), revetted if practicable, and provided with seats or supports. They must be kept constantly clean; the excreta covered with earth and the position changed when the pit is three-quarters full. When trenches are occupied for more than a few days the excreta must be caught in tins and removed daily. They are usually arranged on both sides of a special communicating trench, which should be paved with stones for about 10 yards.

281. *Lavatories.*—These should be improvised of tin or wood so as to form a number of basins in a row, with holes in the bottom, placed above a trough which receives and carries off the water to a drainage pit. There should be a grating for the men to stand on and the floor of the trench should have a decided slope for drainage. They should be constructed on a special trench, covered if practicable.

282. *Shower baths.*—These should be installed in a deep shelter or a cave shelter. A simple arrangement is to provide

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one or two kettles for heating water, tubs or casks for storing it, placed about 9 feet above the ceiling of the shelter. The casks should be connected with a pipe fitted with sprinklers, properly spaced. There should be a grating on the floor and the bottom of the approach trench should have a steep slope toward a drainage pit.

283. *Water supply.*—This usually consists of several large casks filled through pipes if practicable; otherwise the water is carried to them. There should be an interval of at least 10 yards between casks to avoid crowding and mud puddles. (Pl. VII.)

284. *Sign-posting the approach and communicating trenches.*—At all crossings two sign boards must be set into the berm so that they may be seen by a person going in either direction. An approach must keep its name or number throughout its length. At all crossings the main approach should be about a foot deeper than the intersecting trenches or minor approach. Generally separate approach trenches should be provided for traffic to the front (in) and to the rear (out). Everything that hinders movement in approach and communicating trenches should be rigidly suppressed.

285. *Maintenance.*—Order and sanitary conditions must be rigidly exacted in the trenches, or they will soon become untenable or very unhealthful. The trenches after prolonged use deteriorate, not only from the fire of the enemy, but also from the effects of the weather. They must be constantly repaired. Walls which break down must be revetted; firing banquettes must be constantly repaired with planks, fascines, or other revetting material. Damaged parapets must be repaired; berms must be kept at proper width. Drainage pits must be watched carefully and kept cleaned out. It requires constant

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work to keep the trenches clean and sanitary. Any commander who tolerates lack of work or poor work under any pretext is wanting in the first duty of a commander.

When parts of trenches are captured, steps must be taken immediately to clear them of insects which swarm in them and transmit disease germs, particularly typhus. Straw should be burned in the trenches and shelters, and all woodwork should be whitewashed.

286. *Protection against asphyxiating gas.*—The principal and most effective protection is to provide all occupants of trenches with gas masks, and require them to be constantly ready to put them on when the gas alarm is given. They must not be removed except by order of the senior officer or noncommissioned officer present. For the protection of shelters, see par. 313*d* (7). Lookouts should be provided with some means of giving a special alarm at the approach of asphyxiating gas.

287. *Protection against bombs and grenades.*—This is secured by a grill of wire netting placed in front of the trench. The top of the grill should be placed so that a bomb passing over it will clear the trench.

288. *Trip and alarm wires.*—These should be provided at important points. They may be arranged to light a flare or give some other signal to disclose the advance of the enemy. (See Pl. VII.)

289. *Villages and buildings.*—Villages such as are found in Europe, placed in a state of defense, make the best kind of a supporting point. If the defense is properly organized, their capture has usually proved a long and costly operation. Cellars with their roofs shored up and reinforced form excellent shelters, and good communications entirely underground can be made by breaking through from cellar to cellar. The organi-

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zation of the defense of a village is similar to that described for a supporting point. The field of fire for interior lines of resistance must be improved wherever necessary by the thorough demolition of buildings and the removal and spreading of débris. (See Pl. VI.)

It is often advisable to include substantial masonry buildings in the firing line. Experience shows it to be very hard to dislodge a determined defender from a properly organized building. On the other hand, buildings in or near the front invariably draw much artillery fire. For this reason a building should not normally be occupied by day unless it has cellars which can be improved to provide good bombproof cover, or similar cover can be made quite close to the building and connected with it by communicating and approach trenches. Otherwise, if the building has been organized for defense, a garrison should be detailed which will occupy it only at the last moment in case of attack. The defensive arrangements should be concentrated on the first floor and cellar.

In the building itself the work to be done is:

(*a*) Reinforce the cellar roof, with concrete if possible, and shore it up to enable it to carry the extra protection and the débris which shelling will bring down upon it.

(*b*) Loophole the walls as near the ground as practicable.

(*c*) Reinforce the walls up to the loopholes with earth, sandbags, etc.

(*d*) Block up and loophole the ground floor doors and windows.

(*e*) Construct overhead cover over the loopholes to protect from falling débris.

Outside the building, construct firing trenches in front and on the flanks, and connect them and the building by communicating and approach trenches.

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290. *Thickness of material required for protection:*

(*a*) The following thicknesses of material are necessary to stop a Mauser bullet:

Earth, dry, 3 feet 6 inches to 4 feet.
Earth, wet (length of rifle and bayonet), 4 feet 6 inches to 5 feet 6 inches.
Shingle or broken bricks, 8 inches.
Sand, dry, 3 feet.
Sand, wet, 4 feet 6 inches.
Coal, 8 inches.
Sandbags—headers, 2.
Sandbags—stretchers, 3.
Fir wood, 60 inches.
Oak, 40 inches.
Steel plate, ½ inch.
Brickwork, 10 to 15 inches.
Iron plate, 1 inch.

N. B.—The above are not proof against the (exceptional) steel bullet.

(*b*) The following table gives the thickness required for protection against light artillery and trench weapons of low power:

Time fuse:
Earth with flat slope, 16 inches.
Hard wood, 6 inches.
Soft wood. 10 inches.
Brick, 2½ inches.
Sheet steel, 0.1 inch.

Percussion fuse:
3-inch gun, 3 feet 4 inches of earth.
4-inch howitzer, 7 to 10 feet of earth.

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(*c*) The thickness required for protection against heavy artillery and trench weapons of high power is as follows:

6-inch howitzer: 2 layers of logs 6 inches thick and 2 layers of earth 1 foot thick, alternated.

8-inch howitzer: 3 layers of logs 6 inches thick and 3 layers of earth 1 foot thick, alternated and reinforced by flagstones, sacks of cement, rubble, or steel rails.

11-inch howitzer and larger howitzers: 17 to 33 feet of undisturbed earth (cave shelter).

291. *Table of time, men, and tools,* required for the execution of field fortification: The average results of one man-hour labor are given in par. 8, Appendix 7, F. S. R. Except where otherwise stated the material and tools are assumed to be on the site of the work. All tracing and marking out is to be done before the distribution of the working parties at the sites. Not more than five minutes should be consumed in distributing the men or in changing reliefs, if the men have been divided into suitable groups or parties under leaders previously instructed in the nature of the work to be done. One leader or foreman can conveniently supervise up to 20 unskilled men on earthwork. The length of a task when the park tools are used is 2 paces or 5 feet; when the portable tools are used it is 3 feet.

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No.	Nature of work.	Minutes for 1 man.	Per unit of task.	Suitable unit party, men.	Tools per party.	Remarks.
	INTRENCHING.					
1	Excavation only...	3	1 cubic foot.	1	1 shovel and 1 pick.	For average work of 1 man for each hour of work, see par. 8, App. 7, F. S. R.
2	Firing trench, fig. 2, App. 2, F. S. R.	80	5 feet or 37 cubic feet.	1	.....do.....	If tools are double manned, time can be reduced to 60 minutes.
3	Firing trench, fig. 4, App. 2, F. S. R.	300	5 feet, or 87 cubic feet.	1 or 2	.....do.....	If tools are double manned and first pair relieved after 2 hours, time can be reduced to 150 minutes.
4	Firing trench, sec. AB, Pl. III.	420	5 feet, or 112 cubic feet.	1 or 2	.....do.....	If tools are double manned and first pair relieved after 2 hours, time can be reduced to 180 minutes.
5	Approach trench, sec. EF, Pl. III.	450	5 feet, or 115 cubic feet.	1 or 2	.....do.....	If tools are double manned and first pair relieved after 2 hours, time can be reduced to 190 minutes.
6	Filling sandbags....	3	1 sandbag.	3	2 shovels.....	Average for 2 hours' work; 120 bags filled by 3 men.
7	Head cover, of sandbags or sods.	60	1 loophole	1	1 shovel.....	Up to 12 (sandbags or sods).
8	Overhead cover added to head cover.	60	1 rifle.....	1	1 shovel, 1 hand ax.	Allow 25 square feet of roofing per rifle, in addition to necessary supports.
	REVETMENTS.					
9	Brushwood, rough or planks.	1½	1 square foot.	2	1 bolo, 1 hand ax.	Allow 4 pounds brush and 1 foot wire per square foot revetted.
10	Brushwood as hurdle work.	2	.....do....	2	.....do.....	Do.
11	Sandbag.....	3	.....do....	2	.....	Sandbags already filled, alternate headers and stretchers, 2 bags per square foot.

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No.	Nature of work.	Minutes for 1 man.	Per unit of task.	Suitable unit party, men.	Tools per party.	Remarks.
	REVETMENTS.					
12	Sods	6	1 sq. foot	2	1 shovel	5 sods, 18 by 9 by 4 per square foot.
13	Cutting sod for 12	9	do	3	3 shovels	30 sods per man per hour, working 4 hours.
14	Hurdles, rough making.	60	1 hurdle	3	2 bolos, 1 hand ax, 1 pliers.	75 pounds brush and 60 feet wire per hurdle, 6 feet by 2 feet 9 inches.
15	Fascines, making	240	1 fascine	4	3 bolos, 1 hand ax, 1 pliers, 1 choker, 1 saw.	200 pounds brush and 60 feet wire per fascine 18 feet long by 9 inches diameter. Cradle for making requires 10 pickets, 6½ feet by 3 inches diameter.
	CLEARING.					
16	Trees, felling	1	1 inch of diameter.	1	1 ax or saw	Over 12 inches diameter allow time in min. $= d^2/144$, where d = mean diam. in in.
17	Woods, clearing of brush and small trees.	2½	1 square yard.	20	9 bolos, 8 hand axes, 3 axes.	All felling at first, then part removing or collecting. Produce 5 pounds brush per square yard.
18	Brick wall, notches in.	10	1 notch	1	1 pick or crowbar.	Walls up to 18 inches thick. Obtain stone chisel and hammer if possible.
19	Brick walls, loopholes in.	30	1 loophole.	1	do	Do.
	OBSTACLES.					
20	Abatis, wired	120	1 linear yard.	20	As for 17, also 3 pliers, 1 shovel, 1 pick mattock.	1 strong row. Material close at hand. 20 yards wire per linear yard per row. Each butt anchored by wiring to heavy pickets well driven.
21	Wire entanglement.	30	1 square yard.	3	1 ax, 1 pliers, 1 saw, 3 gripping pads.	1 post 4 to 6 feet long per 4 square yards. 30 feet wire per square yard.

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292. *A working party table.*—The following form may be useful to facilitate rapid commencement of work and to insure that men and tools are employed in the most advantageous manner. The commander of the unit concerned (in this case a battalion) details his men and tools to the works in respective order of importance, as indicated by their order in the table. Should the tools with the unit not be sufficient, the commander would then apply to his superior for the remainder. The latter would then fill in the last column, showing where the additional tools required were to be obtained.

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SHERIDAN RIDGE POSITION, SUPPORTING POINT ON HILL 855 AND ADJOINING NOSES.

SECOND BATTALION, FIFTH INFANTRY.

Task. (Map of Fort Leavenworth, Kans. R. F. 1/10,560.)	Men, number from.	Tools required.	Tools with unit.	Balance to complete.	Remarks.
1. Company trench at 855, divided by traverses into 16 squad bays; 12, 20 feet long; 4, 18 feet long. Soil easy. (Fig. 2, App. 2, F. S. R.) Time, 2 hours.	128, E Co..	68 shovels.....	68	.....	Use own portable and park tools and park tools of F Co. Each 20-foot squad bay constructed with 4 shovels and 2 picks, park. Each 18 feet, with 6 portable tools. Remainder of portable tools used to construct trench around traverses.
		34 pick mattocks.	34	.....	
		48 shovels.....	24	24 park..	
		24 pick mattocks.	12	12 park..	
2. Firing trench for 3 platoons (12 squad bays) on nose 300 yards south of 855. Trench for 1 platoon (4 squad bays) 50 yards to south. (Fig. 2, App. 2, F. S. R.) Time, 2 hours.	128, H Co..	68 shovels.....	68	.....	Use own portable and park tools and park tools of M Co. Tools used as in E Co. 12 squad bays, 20 feet long; 4, 18 feet long. M Co. is in regimental reserve.
		34 pick mattocks.	34	.....	
		48 shovels.....	24	24 park..	
		24 pick mattocks.	12	12 park..	
3. Firing trench for 1 platoon (4 squad bays) 50 yards to north of H Company. (Fig. 2, App. 2, F. S. R.) Time, 2 hours.	32, G Co...	17 shovels.....	17	.....	1 20-foot, 3 18-foot squad bays.
		8 pick mattocks.	8	.....	
		6 shovels.....	6	.....	
		3 pick mattocks.	3	.....	
4. Clearing. Trees in Salt Creek west of 855. Zalinsky house, barn, orchard; trees west of H Company trench. Mark ranges. Time, 2 hours.	40 Engineers.	3 saws.....	3	.....	Engineers also use demolition outfit. F and M Cos. use own and all of bn. portable and park tools, 216 trees 8 to 16 inches, 80 orchard trees 4 inches.
	128, F Co..	13 axes.....	13	.....	
	128, M Co.	3 hatchets.....	3	.....	
		18 machetes...	18	.....	
		2 sledge hammers.	2	.....	

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5. Approach trenches. 2 feet parapet, 18 inches wide, 4 feet deep. Time, 2 hours.	96, G Co...	1 pinch bar....	1	.....	Approach to E Co. trench 30 yards long; to H Co., 51 yards.
		16 axes.....	2	14 park..	
		40 hand axes...	16	24 port..	
		45 bolos.....	18	27 port..	
		10 saws.....	4	6 park...	
		51 shovels.....	51	.....	
		26 pick mattocks.	26	.....	
		18 shovels.....	18	.....	
		9 pick mattocks.	9	.....	

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293. *Method of executing field fortification work:*

(*a*) When the tactical situation permits the execution of the work in safety:

(1) Establish the trace, place the eye at the height of the interior crest (1 foot). Mark out the trace with stones, stakes, or tape. Mark the points of change of direction (maximum 120°). Mark the position of each traverse between squads (minimum thickness of traverse, 2 yards).

(2) Deploy the working party along the trace by such method as the tactical conditions demand.

(3) Place the rifles and packs on the rear side, the rifles in reach.

(4) Mark out the tasks on the ground with a pick. Mark out the traverses in the same manner.

(5) Strip the sod from the ground to be excavated and rapidly construct a mask or small parapet with it, with a steep slope on the rear.

(6) Dig as vertically as possible. As soon as the parapet affords sufficient protection, the men designated construct the trench around the traverses, commencing at both ends.

(7) Make a parados as soon as the depth of the trench exceeds that for a kneeling trench (2 feet).

(8) Conceal the trenches by means of sod taken from the site of the parapet and parados and give them the appearance of the surrounding ground.

(9) Arrange approaches masked from view by brush, etc.

(10) Proceed with obstacles, head cover, clearing, etc.

(*b*) Night work. When circumstances render night work necessary, special dispositions must be made:

(1) Except when absolutely impossible, stake out the trace before complete darkness.

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(2) If the trace can be marked only at night, utilize visible reference points such as white paper, stones, or tape, flash lights, etc.

(3) For the distribution of the work and commencement of it, employ the same principles as for daywork.

(4) Avoid, except the inevitable noise of the tools, anything that may reveal the presence of the workers (cigarettes, conversation, etc.).

(5) Protect the workers by patrols stationed to the front.

CAMOUFLAGE.

294. Air reconnaissance discovers emplacements by—

(*a*) Their shadows.

(*b*) Fresh earth, sharp lines, movement.

(*c*) Wheel tracks, blast effects, flashes.

295. Camouflage is obtained by the use of—

(*a*) Painted canvas.

(*b*) Palm fiber (raffia) on wire netting.

(*c*) Canvas strips on wire netting.

296. Canvas must—

(*a*) Be sloped at least 30° to eliminate shadow if over raised objects.

(*b*) Cover every particle of earthwork marks, all materials used and every movement while working, etc.

(*c*) Be supported throughout to eliminate flapping and loss of the colors applied and ripping or tearing.

(*d*) Show no straight lines.

297. Raffia netting should—

(*a*) Be dyed.

(*b*) About half-cover the netting;

(*c*) Usually be supplemented with local grass.

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It may be imitated or replaced locally with bunches of hay tied on the netting and lightly painted.

298. Canvas strips should be—

(*a*) Colored.

(*b*) About 8 by ¾ inch.

(*c*) Knotted on wire netting.

299. Raffia and canvas strips are lighter than and not so affected by wind, blast, etc., as canvas.

300. For the application of suitable camouflage it is indispensable that local surroundings and conditions be studied. It is most essential that concealment shall be provided before work commences. To apply camouflage to completed work is to advertise its importance.

301. Color is useless unless it gives the impression of depth and form. There must be shading. A grass-green canvas, for example, will show up light in a photograph and appear like a plane surface.

302. If oil paints are used the color must be flattened by an excess of turpentine to prevent a shining surface. Oil painted canvas must not be folded for storage; it is liable to spontaneous combustion.

303. To conceal movement on a road from hostile observation at a distance of 4,000 yards under most favorable conditions of light and vision wire netting must be about two-thirds covered. Branches, bunches of hay, raffia with local vegetation that will stir in the breeze, are better than canvas strips.

304. The identity of solid objects is concealed by the use of large, bold patches of green, cream, and brown, with one-half inch bands of black about the blotches. Green and brown occur frequently in nature; cream separates them. The object is to give the impression of a number of dissociated pieces. Patterns must not stop at an edge.

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305. An observation loophole may be concealed by painted gauze. This will impede view with glasses above 200 yards, but such loopholes *must* be hidden from observation at short distance or the observer will be discovered. Beyond 200 yards a *small* slit, *carefully made* where there is a natural shadow, may be made without danger. A black hole is the most conspicuous of things.

306. *Good* observation and invisibility of the observer are better than *excellent* observation with insecurity.

307. Suggestions for concealment of—

(*a*) Tracks:

(1) A grass or canvas covering.

(2) A confusion of tracks stopping at a dummy emplacement.

(3) Continuing the track, on canvas, over the emplacement.

(*b*) Blast mark—removable canvas or raffia.

(*c*) Trench mortar emplacement—painted shell hole.

(*d*) Sniper's post:

(1) Make sandbag parapet with many choke ends outward. These break the surface, distract the eye, and facilitate concealment of loopholes.

(2) Select parapet well covered with old cans.

(*e*) Road:

(1) Screen.

(2) A wall or hedge on near side duplicated on the other, and the real one then removed.

BRIDGES AND BRIDGING EXPEDIENTS.

(Ponton Manual, 1915; Part II, E. F. M.; Examination and Repair of Simple Highway Bridges, Sherrill, 1909; Notes on Bridges and Bridging, Spalding, 1916.)

308. *General considerations.*—When an army has to cross a stream passage may be made on a bridge, by fording, by use of

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boats, rafts or ferries, or on ice. Tactical requirements will determine the general location of the point of crossing, and within the limits imposed by these requirements the site of crossing must be selected and the method adopted that is best suited to the site.

BRIDGES.

309. When once constructed a bridge is the most rapid means of crossing a stream. Its disadvantages are the time and material required and the small chance of secrecy in its construction.

310. *Selection of site.*—The site is selected as a result of reconnaissance to verify and complete the information shown by existing maps. To meet tactical requirements the near shore in an advance should afford concealment for the preparatory work in connection with the bridge, and should, if possible, facilitate a converging fire upon the enemy, while the farther shore should be open to favor development. In a retreat it is desirable that the near shore shall have high ground suitable for defensive positions, while the farther shore should favor concealment. The best site is in a straight reach or a gentle bend; if in a bend the passage should be toward the convex bank in an advance and toward the concave bank in a retreat. The immediate banks should be firm and of equal height, the current regular, moderate, and parallel to the banks, and the bed should afford good anchorage and be free from snags, bowlders, and other obstructions. The velocity of current can be measured by timing the passage of a floating object over a measured length of stream. If not in excess of 3 or 4 feet per second no special difficulty need be expected; with greater velocities it will be necessary to use precautions such as extra anchors or guy ropes leading to points on the banks upstream.

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311. The reconnaissance should furnish information as to the liability of freshets and their probable height, the rise and fall in tidal streams, the width and depth of the stream, the presence or absence of navigation, the nature of existing facilities such as roads or fords, and the presence of bridge material such as timber, rope, or wire. The depth can be measured by sounding with a pole or a sounding line. The width should be measured as accurately as practicable. Narrow streams can be measured by stretching a line across. Wider streams can be measured by triangulation from a base line, using the most accurate instrument at hand. Tributary streams near the site, especially if concealed from the view of the enemy, are advantageous, as they may be used for storage of material or the construction of parts of the bridge which are afterwards floated into place. An island may facilitate crossing by reducing the length of bridge required or affording secure anchorage for a bridge built below the island. The approaches are important. An easy exit is particularly essential. A bridge easy of access and difficult of exit will cause crowding, accidents, and delay. Where possible, the approaches should be straight and in line with the bridge for at least 20 yards next to the bridge; the grades should not be steeper than 1 on 10 if possible, and in no case steeper than 1 on 7.

312. *Kinds of bridges.*—The kind of bridge to be built depends on the nature of the obstacle to be crossed, the load to be carried, and the materials and time available. Military bridges are divided primarily into floating and fixed. The types of floating bridges most commonly used are the ponton bridge, built with the equipage carried with the army, and bridges built with boats or barges. Types less frequently used are the bridges built with casks, rafts, timber, inflated skins, and other means in the nature

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of bridging expedients, which are treated later. The fixed bridges best adapted to military use are pile, trestle, spar, and suspension bridges. Other types that may be used at times are cribwork, steel girder, trussed, and cantilever bridges. The type selected should fit the conditions of the site, should be of simple design, and should admit of easy and rapid construction.

PONTON BRIDGES.

313. There are two kinds of ponton bridges—those built with the heavy equipage intended to pass large armies and their trains over streams of any size, and those built with the light equipage intended to be used with rapidly moving columns, such as cavalry expeditions, and to carry all the loads incident to such service.

314. *Heavy equipage.*—With each Army corps there is an engineer train carrying, among other things, one ponton train of three heavy divisions—two motor-drawn and one mule-drawn. Each ponton division contains the materials for 225 feet of bridge. Each ponton division has 8 pontons, 2 trestles, and other necessary materials for 11 bays or spans. The supports are the abutments on shore, the trestles, and the pontons. The roadway bearers are wooden beams called balks, 5 inches by 5 inches in cross section, and of two lengths, 27 feet and 21 feet 8 inches. The roadway is formed of plank called chess, each 1½ inches by 12 inches by 13 feet. The chess are held in place by side rails, which are balks laid on top of the chess and lashed to the balks under the chess. The pontons are flat-bottomed wooden boats, 31 feet long, 5 feet 8 inches wide, and 2 feet 8 inches deep at the center.

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315. *Light equipage.*—With each cavalry division there is an engineer train, of which the ponton section consists of three divisions, each having 8 pontons, 2 trestles, and other materials sufficient for 185 feet of bridge. By combing the three ponton divisions a bridge about 510 feet long may be built. The ponton consists of a frame which is knocked down for transportation and assembled when needed. A canvas cover placed on the frame completes the ponton, which is 21 feet long, 5 feet 4 inches wide, and 2 feet 4 inches deep. The balks are 4½ inches by 4½ inches by 22 feet, except the trestle balks, which are 5 inches by 5 inches by 21 feet 8 inches. The chess are 1½ inches by 12 inches by 11 feet. The canvas pontons will not resist ice nor driftwood, and they are liable to injury in handling on shore or in water containing snags. In spite of these disadvantages the light equipage makes a practicable and satisfactory bridge.

316. *Standard heavy bridge.*—The bridge starts from a sill laid on the bank near the water's edge. If the water is too shallow for a ponton at 20 feet out from the sill, a trestle is used as the first support in the water. Additional trestles may be used if necessary and available. Pontons are then added to the bridge and are spaced 20 feet center to center. This is known as the construction by successive pontons and is the usual way of building the bridge. The bridge may be completed at the far side of the river with a trestle and a sill, or if there is deep water close to shore the trestle may be omitted. In a river with a moderate current each alternate ponton is anchored upstream and each fourth one is anchored downstream. Every ponton that has a downstream anchor must also have an upstream anchor.

317. The normal heavy bridge will carry infantry in column of squads, cavalry in column of twos, or a concentrated load of

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4,750 pounds. By increasing the equipage 25 per cent and reducing the span between boats, the concentrated load may be increased to 6,700 pounds. By increasing the equipage 50 per cent and further reducing the span, a concentrated load of 13,700 pounds may be carried. If there is a shortage of material, the interval between boats may be increased, in which case the capacity is reduced to a concentrated load of 3,400 pounds. The normal heavy bridge will carry the 3-inch field gun or the loaded escort wagon. It will carry the 1½-ton truck unloaded. If seven balk are used instead of five, it will carry this truck fully loaded, or the 4.7-inch gun, or the 3-ton truck unloaded. The 3-ton truck fully loaded can be carried only in case the equipage is increased 50 per cent and the spans correspondingly reduced as mentioned above, and then only if an additional or much heavier floor is laid over the balk. In no case should the concentrated load placed on the bridge exceed 13,700 pounds, and whenever it is desirable to pass a load in excess of the prescribed load for the bridge as built, the operation should be under the personal supervision of the engineer officer in charge of the bridge.

318. ***Standard light bridge.***—The bridge with the light equipage is built in the same way as the heavy bridge. The spans are shorter than in the normal heavy bridge, the pontons being 15 feet 6 inches center to center, or 10 feet 2 inches in the clear. The light bridge will carry infantry in column of squads, cavalry in column of twos, the 3-inch field gun, the loaded escort wagon, or the 1½-ton truck unloaded. Nothing is gained by increasing the quantity of light equipage in a given length of bridge, as the normal bridge will carry as great a load as the boats will safely support.

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319. *Weight of troops.*—Some of the loads (in pounds per linear foot) to which military bridges may be subjected are as follows:

Infantry, single file	140
Infantry, column of twos	280
Infantry, column of fours	560
Cavalry, single file	196
Cavalry, column of twos	392

Infantry in heavy marching order will average 200 pounds per man, and when unarmed 160 pounds. Infantry crowded in a disorganized mass may weigh as much as 133 pounds per square foot of standing room.

320. *Transportation of equipage.*—When moved by rail pontoon equipage will preferably be shipped with all wagons fully loaded. The 40-foot car of the end-opening gondola type is the most suitable, but flat cars can be used. Cars shorter than 36 feet are unsuitable. Each division of heavy equipage requires ten 40-foot cars, and each division of light equipage seven. For over-sea transportation the loads are removed from the wagons and the latter are taken apart. The pontoons should be stowed so as to be readily accessible for use in landing.

FIXED BRIDGES.

321. *Pile bridges.*—Piles are posts driven into the ground, generally in a vertical position. They are driven in bents, usually of three or four piles each. If more than 10 feet high the bent should be strengthened with sway braces, which are diagonal planks spiked or bolted to the piles. The piles may be driven with a maul, or with a pile driver operated by hand or by machinery. The bent is completed by sawing off the piles at

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the same level and placing on them a heavy timber called a cap, which is fastened to each pile with a drift bolt. The roadway bearers are laid from bent to bent, preferably extending over two bents and breaking joints. The bearing power of a pile is given by the formula

$$L=\frac{2wh}{s+1}$$

in which

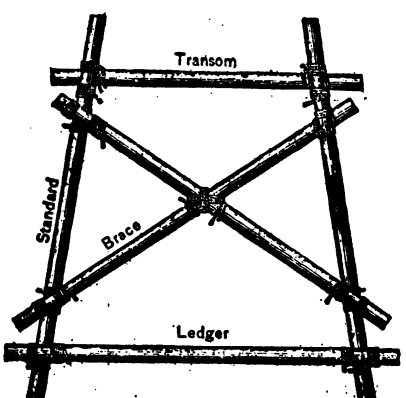
L is the safe load in pounds.

w is the weight of the hammer in pounds.

h is the fall of the hammer in feet (average of last few blows).

s is the penetration per blow in inches (average of last few blows).

322. *Trestle bridges.*—This type is applicable in a shallow stream with a firm bottom. Trestles may be framed of dimen-



sion lumber, or, as is more usual, they may be made of timber cut in the vicinity of the bridge. Types of trestles are illus-

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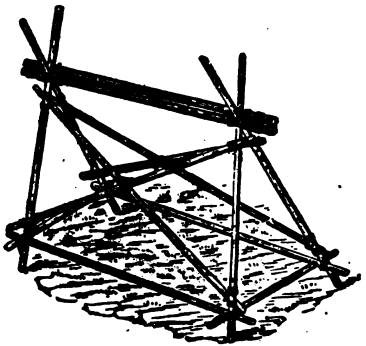
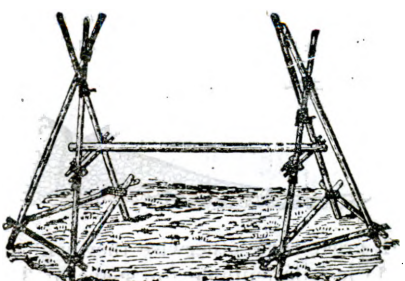
trated. A bridge may be built with the trestles forming a part of the ponton equipage if the depth of the stream and the



nature of the bottom are favorable. This is a two-legged trestle that may be quickly put together and launched in place from



a ponton. Trestle bridges are dangerous in streams having a soft bottom and a swift current, as the bottom is liable to scour around the trestles, causing them to give way under a load.

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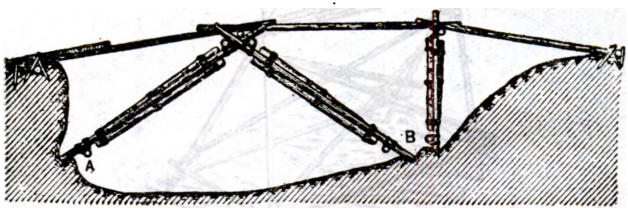
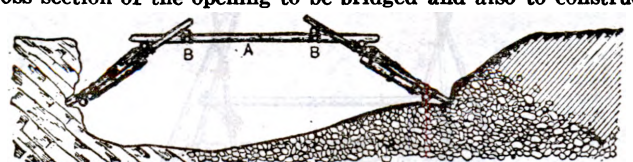
323. *Spar bridges.*—These are bridges built with round timbers lashed together, and are used for crossing comparatively narrow and deep depressions, either watercourses or dry ravines. There are two general forms, the single lock and the double lock. In the first form, two inclined frames meet and lock together at their tops. In the second form, two inclined frames each



meet and lock with an end of an intermediate frame lying horizontally between their tops. Each frame is built like the two-legged trestle. In each case the roadway is completed with round or sawn timbers, depending on what is available. In building a spar bridge it is important to make an accurate cross section of the opening to be bridged and also to construct



the frames with great care, otherwise they will not lock properly. The single lock is suitable for spans of 30 feet or less, and the double lock for spans not exceeding 45 feet. The most important members, the legs or standards of the frames and the crosspieces or transoms that carry the roadway, should be timbers 8 to 10 inches in diameter. The roadway bearers or balks

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should be 6 inches in diameter for spans of 15 feet. The remaining timbers may be from 3 to 6 inches in diameter. The lashings are made with rope one-half inch in diameter; 1 inch diameter rope is required for handling the frames and lowering them into place.

324. *Suspension bridges.*—These are used for light loads and long spans. The construction of a suspension bridge for heavy traffic will usually be impracticable with field equipment. For a span of 150 feet and a live load of 200 pounds to the linear foot each main cable should consist of four ¾-inch steel wire ropes. The towers will usually have to be trees or timber trestles. The anchorages will be large stumps or bowlders, or ledge rock.

325. *Cribwork pier bridges.*—Very satisfactory supports for a bridge may be made of cribs built up with logs or sawn timber. In dry locations the cribs are built in place; when the cribs are to go in water they are built on shore, launched and floated to position. Ballast is used to hold them in place. If the bottom is likely to be scoured by the current around the crib the crib should rest on a brush mattress covering the bottom. Railroad ties are good material for building small cribs.

326. *Fastenings.*—The following table shows the dimensions and weights of—

COMMON STEEL WIRE NAILS.

Sizes.	Diameter.	Length.	Number per pound.	Sizes.	Diameter.	Length.	Number per pound.
	Inches.	*Inches.*			*Inches.*	*Inches.*	
6-penny	0.115	2	200	16-penny	0.165	3½	46
7-penny	.115	2¼	154	20-penny	.203	4	29
8-penny	.124	2½	106	30-penny	.220	4½	23
9-penny	.124	2¾	85	40-penny	.238	5	17
10-penny	.148	3	74	50-penny	.259	5½	13½
12-penny	.143	3¼	57	60-penny	.284	6	10½

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MAINTENANCE AND CARE OF BRIDGES.

327. A military bridge is placed under the charge of an engineer officer, with a detail of men to act as a guard. The officer has control of all movements across the bridge, and is responsible for its maintenance, repair, and protection. Special precautions are necessary in passing floating bridges. Infantry should break step; all riders and drivers dismount and all animals are led; halting on the bridge should be avoided, except when the bridge is found to be swaying, in which case the column should halt and wait till the bridge becomes steady. All movement across the bridge is at a walk; auto trucks are not to exceed 3 miles per hour. The bridge must be kept free of drift, either by guiding drifting objects through the bridge or by intercepting them above the bridge with booms or otherwise. The bridge may be built with a draw that can be removed to allow the passage of boats, large trees, or other floating matter.

USE OF EXISTING BRIDGES.

328. An existing bridge may be found incapable of carrying military loads on account of weakness of original design, deterioration, or damage by the enemy. To determine whether an existing highway bridge can be used an examination should be made as to the condition of the abutments, the pile bents, trestles or other supports, the stringers, and the planking. Masonry abutments should show no disintegration of stone, and the mortar should be intact in the joints. Concrete should show no disintegration, displacement, or extensive cracking. Timber parts should be examined for decay, breaks, and extensive warping or cracking. Interior decay will be shown by the hollow sound noted when the timber is struck with a hammer and may be further investigated by driving nails or boring with an auger.

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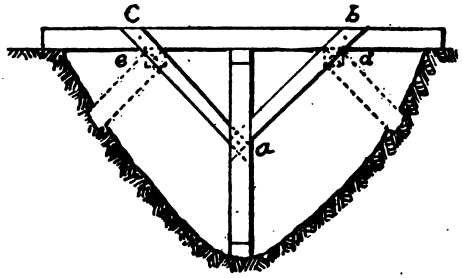
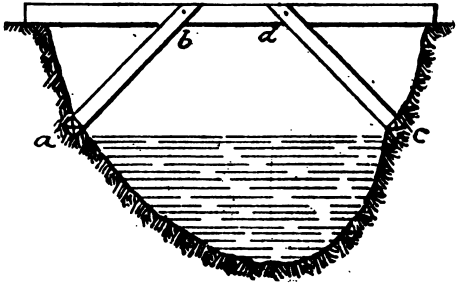
Metal parts should be examined for rust, especially the rivets and the threads of bolts and turnbuckles.

329. If the supports of the bridge are insufficient, the damaged or deteriorated parts may be replaced or additional pile



bents or trestles may be built between those existing. Additional support may be obtained by introducing diagonals as sug-



gested in the sketches in figures *a* to *c*. If timber is scarce and iron or steel rods are available, the method shown in figure *d* may be used. Another method is to build cribwork supports.

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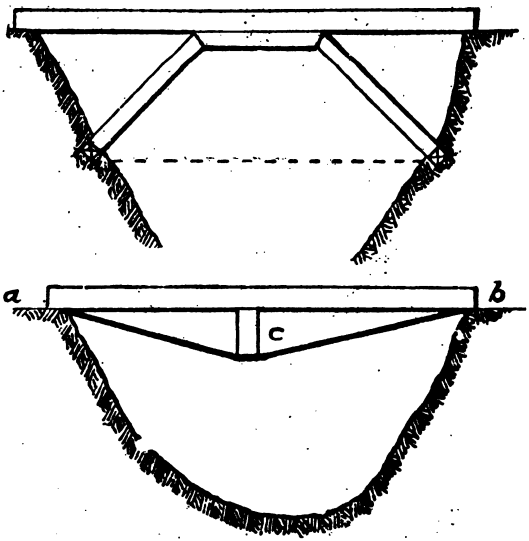

330. The strength of wooden stringers or roadway bearers may be judged from the formula for the strength of beams:

$W = 1/3 \frac{bd^2}{l} \times C$, in which—

W is the concentrated safe load, in pounds. (If load is uniformly distributed, use two-thirds instead of one-third in formula.)

b is the breadth of the stringer, in inches.

d is the depth of the stringer, in inches.

C is a constant for the kind of timber used, which may be taken as 400 for ordinary timbers.

l is the span, in feet.

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From this, having a given load and beam, we can determine the span that may be used: $l = \frac{1}{3} bd^2 \times C$.

For light artillery and wagons, bd^2 must equal or be greater than $15 \times$ span, in feet.

For the 4.7-inch heavy field gun, bd^2 must equal or be greater than $30 \times$ span, in feet.

331. The following table is useful in determining the sizes of round and rectangular stringers and corresponding maximum safe spans:

Round.	Rectangular.	Maximum safe spans in feet for 4 or more balks.	
D.	b x d.	Wagons and light artillery.	Siege artillery.
Inches.	*Inches.*		
5	2 x 6	4.8	.....
6	8	11.2	5.6
7	10	12.6	6.6
.....	12	15.6	9.6
.....	3 x 6	7.2	3.6
8	8	12.6	6.4
.....	10	16.0	10.0
9	12	20.4	14.4
.....	4 x 6	9.6	4.8
.....	8	14.5	8.5
.....	10	19.3	13.3
.....	12	25.2	17.6
.....	6 x 6	13.2	7.2
.....	8	18.8	12.8
10	10	26.0	18.0
.....	12	34.8	22.4
.....	8 x 8	23.0	16.5
11	10	32.5	21.2
.....	12	44.4	27.2
12	10 x 10	39.3	24.6
.....	12	52.0	32.0

332. For flooring a useful rule is that the thickness of the plank in inches should be at least equal to the distance apart of the stringers in feet.

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333. The strength of steel stringers may be judged from the formula: $W = \frac{d^2}{10\,l}$. In which W is the concentrated safe load in pounds; d is the depth of the stringer in inches; and l is the span in feet. From this having a given load and beam we can determine the span that may be used: $l = \frac{d^2}{10\,W}$. For light artillery and wagons, d^2 must equal or be greater than 1.5 × span in feet. For the 4.7-inch heavy field gun, d^2 must equal or be greater than 3 × span in feet.

LANDING PIERS.

334. Temporary piers for the discharge of vessels are usually built in the same manner as bridges with pile or cribwork supports. The principal difference is that a pier has to stand the lateral thrust of vessels making a landing or moved by wave action. The structure must therefore be well braced and should also be protected by fender piles driven either singly or in groups of three or more tightly bound together at their tops. These fender piles are close to the pier but detached from it, and by their elasticity absorb a large part of the shock of vessels.

BRIDGING EXPEDIENTS.

335. *Boats.*—Ordinary boats may be used instead of pontons to support a floating bridge. They should, if possible, be of the same size and must have the necessary strength and stiffness. If a boat is not of sufficiently strong construction to permit the load to be applied directly to the gunwales, a transom may be placed lengthwise in the middle of the boat and so supported as to transmit the load to the keel.

336. *Barges.*—In many rivers barges of various sizes and types will be found. The most useful are the decked barges, 50 to 100 feet in length and 20 to 30 feet in width. Small barges

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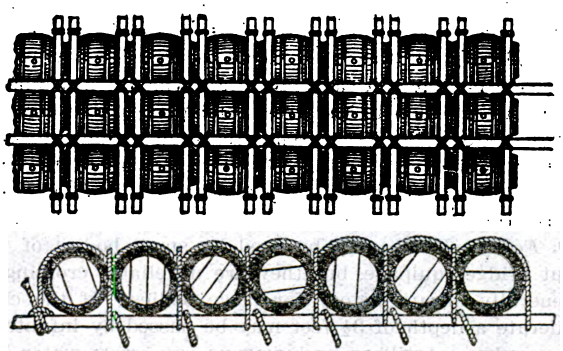
may be used as pontoons; larger ones may be placed with their length crosswise of the stream so as to form part of the roadway of a bridge. When used in the latter position the barges must have especially secure anchorages, on account of the large area exposed to the current. Barges are useful in connection with ferriage operations, as will be described later.

337. *Casks.*—When casks or barrels are available, they may be used to form supports for a floating bridge. Methods of assembling by means of timbers and lashings are shown. The casks should be placed with the bungs uppermost. An ordinary 50-gallon barrel has a buoyancy of about 400 pounds when completely submerged; the buoyancy of other sizes is in proportion to their capacity. In calculations a margin of 20 to 25 per cent should be allowed, as it is not desirable that the barrels shall be completely submerged.

338. Rafts.—Rafts are used when bridge material is lacking or is insufficient to span the stream, or when it is necessary to



transport loads that are beyond the capacity of the bridge material. Excellent rafts may be made with the heavy pontons,

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balk, and chess. They may also be made with the canvas pontons or other boats, with casks or barrels, timber, inflated skins, oil cans, wagon bodies covered with tarpaulins, or tarpaulins stuffed with hay. The essential features are two or more floating parts giving the necessary buoyancy, a framework placed above the floating parts and holding them together, and a floor on which the load can be placed. The raft is moved across the stream by rowing, poling, or pulling with a rope. Under favorable conditions the capacity of a raft made of heavy ponton equipage may be taken as 10,000 pounds for each ponton used.

339. *Ferries.*—The simplest method of moving troops across a stream is to take them across in boats. Use may be made of wooden or canvas pontons, ordinary boats, barges, or rafts. A ferry may be operated by stretching a cable across the river and pulling the boat by hand along the cable. Another method is to use a long rope fastened to a point upstream, either on the bank or to an island or anchor in midstream, and navigate the boat back and forth by utilizing the force of the current acting obliquely on the boat. This is called a flying ferry. The wooden ponton will carry 40 infantrymen armed and fully equipped, in addition to the crew, under favorable conditions. In rough water or swift currents the load should be reduced to 20 men besides the crew. The normal load of the canvas ponton is 20 men and crew; this should be reduced for unfavorable conditions.

340. *Fords.*—Fords may be used by small bodies of troops without bridge equipage, but they are unreliable crossings and are generally unsatisfactory for large bodies. If the current is moderate a depth of 3½ feet may be passed by infantry and 4½ by cavalry. Artillery and wagons can cross water 3 feet

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deep, but if the contents of wagons are to be kept dry the depth should not exceed 2½ feet. The bottom should be even, hard, and tenacious. The presence of large stones, mud, or sand will make fording difficult or impracticable. A ford may be rendered impassable by a freshet or by the deepening resulting from the loss of material stirred up and carried away during the passage of troops. Infantry should cross in column of squads and cavalry in column of twos. All men, animals, and vehicles should maintain sufficient distances to prevent any damming effect on the stream. Boats or mounted men should be stationed downstream to rescue any men that may be swept off their feet. A ford may be destroyed by filling the deepest part with harrows, teeth up, or with planks filled with spikes, with barbed wire, or other obstructions.

341. *Ice.*—New sound ice 3 inches thick will bear infantry in small groups; 4½ inches, cavalry in small groups; 7 inches, wagons and field guns; 9 to 12 inches, the heaviest loads with an army. Planks laid for the wheels will enable vehicles to cross on ice that otherwise would not bear them. A light coating of sand, earth, cinders, or straw will improve the foothold for men and animals. An officer should have charge of the crossing and the movement should be made with great care; crowding must be especially avoided.

342. *Swimming.*—Small parties of selected men may swim a stream successfully, but the attempt to cross with any considerable number by this method is likely to result in heavy losses by drowning. If boats or rafts are available, horses may be taken across by swimming. The horse equipments, except the bridle, are taken off, and a man on the boat or raft holds each horse by the head during the passage. If there is little or no current, the horses can swim on both the upstream

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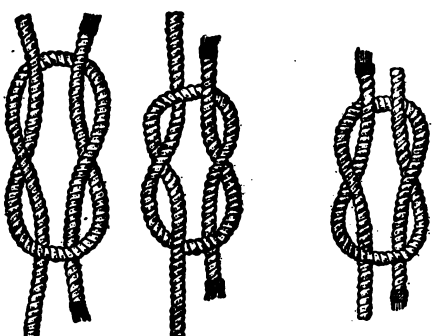
and downstream sides of the boat or raft; if the current is swift, they can swim only on the downstream side. Three horses can be conducted across on one side of a pontoon, or six if they can go on both sides.

CORDAGE.

343. The following are some of the most useful knots for bridge work:

Square knot (fig. *a*), for joining two ropes of the same size. It should not be confused with the *granny* (fig. b), and the *thief knot* (fig. *c*), neither of which will hold.



Clove hitch (fig. *d*), for fastening a rope at right angles to a spar, or at the beginning of a lashing.

Two half hitches (fig. *e*), and *round turn and two half hitches*, (fig. *f*), for making a rope fast to a rope or spar.

Fisherman's bend or *anchor knot* (fig. *g*), for fastening a rope to a ring or anchor.

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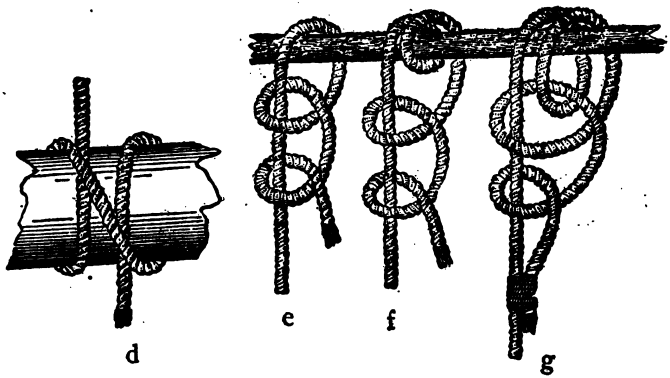

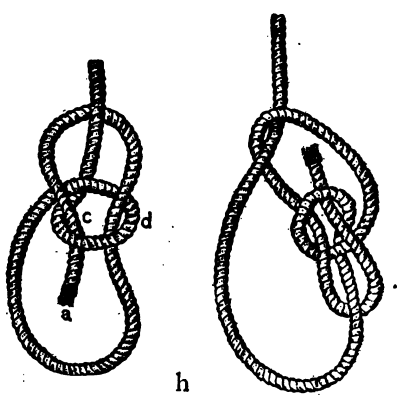

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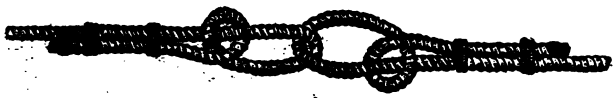

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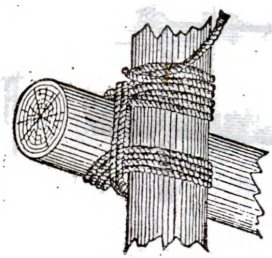

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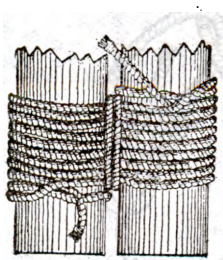

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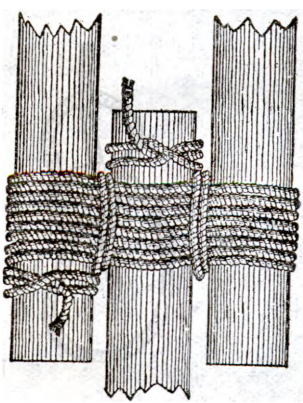

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Bowline (fig. *h*), for making a loop that will not slip.

Hawser bend (fig. *i*), for joining two large cables.

Mooring knot (fig. *k*), for making a boat fast to a pile or post.

Lashings (figs. *l* and *m*), for joining two spars at right angles or parallel to each other, and (fig. *n*), for joining three spars to make a gin or tripod.

344. The following table gives the dimensions, weight, and strength of manila rope:

Diameter.	Circumference.	Weight per 100 feet.	Breaking load.	Proper working load depending upon age and condition.
Inches.	*Inches.*	*Pounds.*	*Pounds.*	*Pounds.*
0.32	1	3.3	780	120–390
.48	1½	7.4	1,600	250–800
.64	2	13.2	2,730	350–1,300
.80	2½	20.6	4,300	600–2,000
.96	3	29.7	6,100	900–2,800
1.11	3½	40.4	8,500	1,100–4,000
1.27	4	52.8	11,600	1,500–5,000
1.43	4½	66.8	15,000	2,000–6,500
1.59	5	82.5	18,400	2,600–8,000
1.75	5½	99.8	22,000	3,000–10,000
1.91	6	119	25,500	3,500–11,500
2.07	6½	139	29,100	4,000–13,000
2.23	7	162	32,700	4,600–15,000
2.39	7½	186	36,300	5,000–16,000

Up to 5 inches circumference rope is made in coils of 1,200 feet each.

345. *Aerial ropeways.*—If a stream has high banks, with trees or other means available as anchorages, it may be practicable to stretch a rope across and transport men and materials in chairs, baskets, or slings suspended from the rope.

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DEMOLITIONS.

(E. F. M., Part V.: Instructions for the Use of the Cavalry Demolition Equipment, 1917.)

346. *Military demolitions* have for their purpose to destroy or make unserviceable any object in the theater of war the preservation of which would be unfavorable to the Army or favorable to the enemy, excepting always objects neutralized by the laws of war.

347. Demolitions of a local character, which have no effect elsewhere, may be made on the order of the immediate commander, as may also demolitions of a more serious character, but which are necessary to the safety of a local force. Demolitions which affect a larger force or a greater territory must be ordered by the commanding general of an army or other force operating independently. In case of doubt, orders should be sought from the highest accessible commander. An officer upon whom work of demolition is devolved should, if not provided with proper orders, ask for them.

348. *Methods.*—Demolitions may be made by fire, by mechanical means, or by explosives. *Fire* is the only recourse when absolute destruction is necessary, as in case of food supplies, munitions of war, structural materials, harvests, buildings, wooden bridges, etc. For quick results with slow burning materials a quantity of highly combustible stuff must be collected. A small fire gains headway very slowly and much time is lost. Care must be taken that the fire does not spread to objects not intended to be destroyed.

Foodstuffs and grain can be ruined and hay damaged by thorough wetting.

349. Demolitions by *mechanical* means is too simple to require and too varied to permit detailed description. Reference

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is made to a few cases in which the best method may not be obvious.

Railroads.—Destroy rolling stock, bridges, culverts, tunnels, or track, or accessories, such as water stations, telegraphs.

Locomotives are temporarily disabled by removing valves or other small vital parts; permanently by building a fire in a dry boiler or by detonating a charge of explosive in the boiler. In haste, piston or connecting rods, links, etc., may be destroyed by explosives or a hole may be blown in the bottom of the tender tank.

Rolling stock may be burned or wrecked by collisions or derailment. The best places are in deep cuts or tunnels. A head-on collision in a tunnel will put it out of use for some time.

Wooden bridges may be burned or small ones may be pried off their seats by levers or dragged off with tackle.

Track may be destroyed by taking it up, burning the ties, heating the rails on the fires and twisting them with bars through the bolt holes with a chain and lever or a hook and lever. Twisting is much better than bending, as twisted rails must be rerolled before they can be used. The rail should be hot for the greater part of its length, so as to make a long twist. A quick track demolition requiring considerable time to repair, but not injuring the track material, may be made by loosening the ties over a stretch of track, taking off the end fish plates, putting a line of men along one side, two men to each tie, and turning the track over bodily. This plan works well on a high embankment.

Telegraph lines are temporarily disabled by *breaks*, in which the wires are cut; *grounds* in which the wires are connected to the ground; and *crosses*, in which a metallic connection is made between the wires. All should be carefully hidden so as to increase the time necessary to locate them.

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To destroy a telegraph line cut down and burn poles, cut and tangle wires, and break insulators.

Guns.—Smash the sights and firing gear; endeavor to dent or burr the corners of the breech-closing wedge, and damage the elevating gear. Unscrew the striker plug and take it out; fire one or two rifle bullets into the opening. Close breech, then withdraw hand lever about 1 inch, and beat down lever until hinge joint is distorted.

Ammunition to be destroyed should be placed in a deep pit and set on fire.

350. *Demolitions with explosives.*—The degree of success attained in demolitions with explosives depends upon the experience of the powder men doing the work. The explosive adopted for our service is *triton* (trinitrotoluene, trinitrotoluol, trotyl, TNT). It may often become necessary to use whatever explosive is at hand; for this reason data for their use is given. The best results can be obtained with any particular explosive only after much practice, and in using an unfamiliar one the maxim should be: "Do not spare the powder." There are many uncertainties attending the military use of explosives, and local conditions frequently raise a doubt as to the efficiency of the application of formulated methods. For this reason the weight of the charge should often be increased as much as 50 per cent over what might be used under more favorable conditions. Similarly, judgment has to be used in the employment of strange caps, for in military work the two unpardonable mistakes are to have the charge too small or to have it fail to explode. When in doubt as to the effectiveness of the caps, use two or more close together. Where a lifting effect is desired, gunpowder should be used; but, when a cutting or shattering effect is necessary, a high explosive is better, such as triton, dynamite, guncotton.

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351. *Triton* is a neutral compound, very stable, of great strength, yet highly insensitive. It is furnished with the demolition outfit in compressed block form. The strongest of detonators should be used, especially if the blocks are highly compressed. Lead azide detonators are particularly effective; as are also the tetryl caps which are the standard detonators for our service. Triton absorbs moisture, making detonation very difficult. For this reason and to prevent crumbling, the blocks are given a thin electro-plating of copper. Tetryl caps will detonate water-soaked triton. There are no objectionable gases of explosion, but a heavy black smoke is produced, due to free carbon.

352. *Dynamites* consist of a granular base, usually called dope, partly saturated with nitroglycerin. They are classed according to the percentage by weight of the nitroglycerin contained, as 75 per cent dynamite, 60 per cent dynamite, and so on. The grades No. 1, No. 2, and No. 3, often used, refer to 75, 50, and 25 per cent dynamites, respectively. At extremes of temperature, high or low, an *exudation* of free nitroglycerin is likely to occur, making the dynamite *extremely sensitive* and *dangerous*. This danger increases with the degree of saturation. Dynamites higher than 60 per cent will probably not be suitable for military purposes on this account. The tendency to exudation is greater when the cartridges stand on end, and care should be taken to *keep them on the side* in storage and transportation. Dynamite freezes in moderately cold weather (40°), and if no exudation has taken place becomes comparatively free from danger of explosion by concussion and is considered perfectly safe to handle. It is very difficult to explode when frozen, has less strength, and is not considered fit to use in that condition. In the frozen state, it is easily exploded by heat and the operation of thawing, if carelessly conducted, is one of great danger.

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It should never be taken near a fire or very hot metal, but should be thawed in a mild, diffused heat, acting for a considerable time. The cartridge must never be placed on end to thaw out. Packing in fresh manure, or inclosing in a chamber with cans of hot water are the safest methods of thawing dynamite. Plenty of time must be given. A cartridge soft on the outside may be frozen in the middle. None of the dynamites are fit for use as a military explosive in a cold climate. It is usually packed in paraffined paper cartridges about 1¼ inches diameter by 8 inches long, containing about 0.6 of a pound.

353. *Guncotton* has been used extensively in military operations and has some advantages. When dry it is apt to deteriorate; when wet it is perfectly safe, but can be fired only by a primer of dry guncotton or other high explosive. The dry cotton must be kept perfectly dry and separate from the wet. It is difficult to fuse unless holes are left in the cartridge to receive the cap. The wet should be kept *saturated* with 30 per cent of its weight of water. If dry primers are not at hand, wet cakes must be dried at a temperature not exceeding 120° F.

354. *Gunpowder* charges must be tamped, and should be made up in as compact a form as possible. The powder should be placed in a well-tarred sandbag, or, failing that, in one sandbag inside a second one. A sandbag will hold about 40 pounds.

355. *Firing devices.*—High explosives can be fired by *detonation* only. The detonating cap usually consists of a small quantity of fulminate of mercury inclosed in a copper cap or fuse. The fulminate is easily ignited and very violent; it is unstable, corrosive, spoiled by moisture, and highly sensitive to shock and friction. *Caps* and *fuses* must be *carefully*

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handled, must not be assembled in considerable quantities, and must be kept away from the explosive.

Bickford or *safety fuse* is used to ignite the fulminate when electricty is not available. It may be used in wet holes, but for under-water use it should have a continuous rubber coating.

Time fuse burns at an average rate of 3 feet per minute. When time is important the rate of burning should be tested.

Instantaneous fuse burns at a rate of 120 feet per minute. The taping is of a different color from the time fuse and it is covered with a netting of coarse thread, making it easily distinguishable by sight and touch, so that there can be no excuse for mistaking one fuse from the other, day or night.

For firing by *electricity* a magneto-electric machine is used with an electrical cap.

356. *A charge is connected up for detonation* as follows: The fuse (time alone or time with instantaneous) is cut to the required length. The end to be ignited is cut on a slant to expose as much powder as possible. The end to be inserted in the cap is cut straight across, and is then gently inserted into the open end of the cap. This end of the cap is then crimped to make it grip on the fuse and so prevent its being withdrawn. The cap is placed in close contact with the charge or in one of the holes in a block so as to fill the entire length of the hole. If the hole is too large, a piece of paper or grass must be wrapped around the cap to make it fit tightly; if too small, it must be enlarged with a piece of wood, but not with the cap. The charge must be in close contact with the object to be demolished, and each slab or block must be in contact with those next to it.

357. The amount of guncotton (untamped) required for various charges can be calculated or obtained direct from the following table: For triton the charge should be increased by

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one-sixth; for 50 per cent dynamite, two-thirds; for 75 per cent dynamite the charge is the same as for guncotton. If the charge is tamped, the amount can be halved. In the presence of the enemy charges may be placed hurriedly, and so under unfavorable conditions, and therefore should be increased by 50 per cent.

358. TABLE OF CHARGES.

Object attacked.	Charge, in pounds.	Remarks.
Masonry arch, haunch or crown	$\frac{2}{3}$ BT^2.....	Continuous charges.
Masonry wall, up to 2 feet thick	2 per foot..	Length of breech B not to be less than the height of the wall to be brought down.
Masonry wall, over 2 feet thick.	$\frac{1}{2}$ BT^2.....	
Masonry pier.....	$\frac{2}{3}$ BT^2.....	
Hardwood, auger hole.....	$\frac{2}{3}$ T^2.....	Where the timber is not round, T± smaller axis. Soft wood half this.
Guns.....	.....	For 3-inch gun use 2 pounds. Double the charge for every inch increase in caliber.
First-class rail.....	1.....	Charge fastened against the web near a chair (if used).
Steel plate.....	$\frac{2}{3}$ Bt^2.....	t is in *inches*.
Steel wire cable.....	1.....	Up to 5 inches circumference; above 5 inches multiply by $C^2/24$, C being the circumference in inches.

In the above table,

B=length to be demolished in *feet*.

T=thickness to be demolished in *feet*.

t =thickness to be demolished in *inches* (in case of steel plate only).

For emergency purposes BT^2 is effective with all classes of masonry and $2Bt^2$ for all steelwork. A slab will cut its own thickness of steel plate. The charge must extend across the whole length of the object to be cut.

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359. *Special cases.—Masonry bridges.*—Attack pier where thinnest; if possible cut groove, or else tie charge to a board and fix it against pier. Thick piers, attack haunches. Dig trench to back of arch ring at each haunch and lay charge. If time is short attack crown.

Houses.—(Weakly built)—Put charge in center of each room or fireplaces; fire simultaneously; four-room cottage, 6 to 12 pounds.

Steel bridges.—Attack main girders near abutment. For hasty demolitions of spans 20–80 feet $C=\frac{L^2}{15D}$. Where C=charge of guncotton for one girder of single-line standard railway, L= length of girder in feet; D=total depth of girder in feet. Where one girder has to bear the whole load of a line of railway, i, e., two girders carrying a double line, the amount given by the formula should be doubled.

Guns.—Load with shell, pack in charge in contact with shell and sides of chamber; connect up charge, add sods, earth, etc., to keep it in place and to tamp it; close breech as far as possible. A shell is not absolutely necessary, but the charge must be tamped.

360. *Demolition equipment.*—Each company of *engineers* carries on each of its two tool wagons a demolition outfit and supplies, consisting of earth and wood augers, pinch bars, magneto exploders, sledge hammers, picks, shovels, firing wire, caps, fuses, etc., and 200 pounds of explosive. In addition it has two pack demolition outfits, each with demolition tools and supplies, including 45 pounds of explosive.

Each squadron of *cavalry* has a pack demolition outfit with demolition equipment and supplies, including 80 pounds of explosive.

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CHAPTER V.

TRANSPORT.

(Part III, F. S. R.)

361. Approximate Weights and Measures of Forage and Subsistence.

Kind of ration.	Gross weight of 1 ration.	Number of rations to a 40,000-pound box car (36 by 8 by 8 feet).	Number of rations to an Army wagon (2,765 pounds).	Number of rations to an auto-truck (3,000 pounds).	Number of rations to a cubic foot.	Number of rations to a ship's ton (40 cubic feet).
Forage:						
Oats—	*Pounds.*					
Horse	12	3,333	230	250	2.564	102.6
Mule	9	4,444	300	333	3.42	136.75
Hay—						
Horse	14	1,571	175	175	.893	[1] 69.69
Mule	14	1,571	175	175	.893	69.69
Barley—						
Horse	12	3,333	230	250	3.205	128.2
Mule	9	4,444	300	333	4.274	170.9
Corn—						
Horse	12	3,333	230	250	3.703	148.15
Mule	9	4,444	300	333	4.94	197.53
Bran—						
Horse	12	2,560	230	250	1.39	55.55
Mule	9	3,333	300	333	1.85	74.07
Subsistence:						
Garrison	4.9	8,226	565	600	6.73	269
Travel	4.1	9,818	675	750	7.76	311
Field	3.0	13,428	920	1,000	9.04	362
Reserve	2.0	20,142	1,380	1,500	13.56	543

[1] Compressed to 82 cubic feet per ton (2,000 pounds), the minimum density for oversea shipments.

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GENERAL PRINCIPLES.

362. The *functions* of transport, its reasons for existence, and objects in operation are briefly—

(*a*) The mobilization of military forces in their respective areas.

(*b*) The transportation of these forces to points of concentration for military operations.

(*c*) The maintenance of equipment and supply to these forces, operating in the zone of the advance, whether same be in friendly or hostile territory and whether over land or over sea.

(*d*) The forwarding of troops to replace losses and maintain combatant strength and the evacuation of the wounded to base or home hospitals.

363. The *sequence* of operations is as follows:

(*a*) From areas of mobilization and supply in home territory to the base or bases of the lines of communication. This is almost wholly transport by commercial railway systems, not Government owned, but in some measure Government controlled, especially in time of war. Commercial railways in the United States are recognized by the law as public utilities of the first order and are subject in the present day to a measure of Government control even in time of peace.

(*b*) From bases of the lines of communication, situated in home territory or on the border line of hostile territory, to the advance bases in the theater of operations. This section is called the zone of the lines of communication. In this section transport is by military railways, or, if operations are over sea, by a combination of military railways and Government owned or chartered vessels, involving ports of embarkation and debarkation between the home and the advance bases.

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(*c*) From the advance bases to the military forces in the theater of operations the section is called the zone of the advance. In this section field transport is almost wholly used, although rail transport may sometimes be available and a valuable aid to the other. *Field transport* is of three general classes, mechanically speaking, and use of these classes will depend upon the nature of the terrain and the character of the roads, viz., motor transport, animal-drawn transport, and pack transport. All classes and kinds of field trains attached to and serving with troops in campaign are comprised under field transport.

364. The *cost of transportation* is one of the largest items of expense in all military operations. Transport must be conserved by all proper means and restrictions or it becomes inefficient. The control of transport must be reserved to those officers in higher authority who are responsible for success of military operations. Proper orders for its use must be obtained from competent authority. In case of commercial carrier these orders must in turn produce the transportation requests and bills of lading or manifests which cover the transportation of men, animals, and supplies, and receipts for which complete the chain of administrative action and create the data for costs of operation essential to the settlement of accounts between the military government and the commercial carriers; or, where the transport is Government owned, insures its application to the strictly necessary purposes and prevents waste of effort and lack of desired result.

365. The *transportation of troops and supplies by commercial carriers* requires—

(*a*) Issue of orders by competent authority.

(*b*) Presentation of such orders to local officer of Q. M. C. for issue of transportation requests (Form 17, Q. M. C.) for

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movement of troops; bills of lading, rail (Form 78, Q. M. C.) or marine (Form 80, Q. M. C.), for movement of freight.

(*c*) Receipt for transportation or accomplishment of the bills of lading to the railroad or steamship company.

366. The *transportation of troops and supplies* by military railroad, Government transport vessel, and by all classes of field transport requires—

(*a*) Issue of orders by competent authority.

(*b*) Presentation of such orders, in duplicate when required, to the officer of the Q. M. C. in charge of the transport at point of its requirement.

RAIL TRANSPORT.

367. *Commercial railroads.*—Service of the interior is carried on under the War Department bureaus, coordinated by the Secretary of War assisted by the General Staff, and all transport, whether commercial or military is under the administration of the Q. M. C. and its various agents.

368. *Military railroads.*—The zone of the line of communications is under the control of its commanding general who is appointed by War Department orders. The service of this zone is subdivided into (*a*) defense; (*b*) supply, sanitary, and telegraph; (*c*) military railroads. The military railroads are in charge of an officer detailed as director of railways who is assisted by such controlling staff as conditions may demand.

GENERAL RULES.

369. (1) Prompt entrainment and detrainment are absolutely essential to efficient troop movement by rail transport.

(2) If in command of troops ordered to move by rail, always ascertain prior to arrival at the entraining point what actual conditions exist as to location of rolling stock, the space and condition of the approaches to same, and the available facilities for loading vehicles and animals.

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(3) Make such dispositions on your march to the entraining point as will enable that unit of your column requiring longest time to entrain to arrive first.

(4) Issue all instructions covering the details of entrainment which your information allows prior to arrival at the entraining point.

(5) Ascertain at the earliest possible moment if the cars for your troops have been inspected and passed as *clean, watered, and ready* by the officer of the Q. M. C. having charge of the transport.

(6) If this inspection has not been made for any reason, make it yourself with the assistance of competent officers, and if the cars are fit proceed with entrainment without delay; if the cars are not in fit condition, make report immediately.

(7) See that the C. Os. of organizations and of units of the field transport personally supervise the loading of animals and vehicles and stores for which they are responsible.

(8) Upon near arrival at destination see that troops are ready to detrain promptly, all personal equipment should be sorted out and put on by the troops before the train stops.

(9) Issue all orders covering detrainment at such hour prior to arrival at destination as will give organization commanders ample time to make and instruct details for detrainment.

(10) See that organization commanders personally supervise the unloading of animals, vehicles, and stores for which they are responsible.

(11) Select an assembly point for your command as near as practicable to the detraining point without blocking the work of detrainment. Have all organizations join you at this point with least possible delay, then march your command away, clearing the detraining point for succeeding troops.

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(12) The work of obtaining, placing, and inspecting rolling stock for troop movements belongs to the Q. M. C. All passenger, baggage, and kitchen cars should be clean, well-aired, steam-heated from the locomotive in cold weather, and provided with sufficient drinking water to last at least to the next water stop. All stock cars should be clean and supplied with hay in the racks for the first day's travel. All box, gondola, and flat cars should be clear of refuse or rubbish or anything creating a fire risk from locomotive sparks or cinders.

(13) The operating condition of all rolling stock belongs to the railroad management, whether same be commercial or under military control. The troop commander has no responsibility in this matter, but if adverse conditions retard the journey a report on same is proper.

370. CAPACITIES OF STANDARD ROLLING STOCK AD FEET 8½ INCHES GAUGE) FOR TROOP MOVEMENTS.

[Dimensions, weights and capacities given are for average class cars; all railroads operate some special cars above and below the figures given.]	Day coaches.	Pullman sleepers.	Tourist sleepers.	Baggage.	Kitchen.	Refrigerator.	Furniture.	Box (standard).	Stock.	Gondolas.	Flats (standard).	Flats (heavy).
Length, average, inside, feet	65	70	60	60	60	30	40	36	36	38	36	40–44
Width, average, inside	....	....	....	9′	9′	8′4″	9′	8′6″	8′8″	9′	8′6″	9′
Height, average, inside	....	....	....	9′	9′	7′4″	10′	8′	7′	[1] 4′	....	....
Weight, empty, tons.	45	55	50	40	40	25	22	20	18	20	15	20–25
Load, capacity, tons.	....	....	....	30	30	25	30	20	20	20	17	30–40
Load, capacity, cubic feet	....	....	....	4,800	4,800	1,800	3,600	2,400	2,100	1,200	....	....
Seating capacity, maximum	64	56	56	....	....	....	....	....	....	....	....	....

[1] Side.

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CAPACITIES OF STANDARD ROLLING STOCK (4 FEET 8½ INCHES GAUGE) FOR TROOP MOVEMENTS—Continued.

[Dimensions, weights and capacities given are for average class cars; all railroads operate some special cars above and below the figures given.]	Day coaches.	Pullman sleepers.	Tourist sleepers.	Baggage.	Kitchen.	Refrigerator.	Furniture.	Box (standard).	Stock.	Gondolas.	Flats (standard).	Flats (heavy).
Regulation troop allotment	48	[1]28 [2]42	[1]28 [2]42	....	....	....	....	30	30	45	....	....
Sleeping capacity, troop allotment	....	[1]28 [2]42	[1]28 [2]42	....	....	....	....	....	....	....	....	....
Animals, draft	....	....	....	....	....	....	19	17	18	....	....	....
Animals, riding or pack	....	....	....	....	....	....	21	19	20	....	....	....
F. A. guns, 3 or 3.8 inch	....	....	....	....	....	....	....	....	....	3	3	3
F. A. caissons, etc	....	....	....	....	....	....	....	....	....	3	3	3
Hosp. ambs., set up	....	....	....	....	....	....	....	....	....	3	3	3
Hosp. amb. bodies with top in place	....	....	....	....	....	....	....	....	....	6	6	6
Escort wagons, set up	....	....	....	....	....	....	....	....	....	3	3	3
Escort wagons, bodies	....	....	....	....	....	....	....	....	....	24	24	24
Wheels and running gear, sets	....	....	....	....	....	....	24	24	24	24	....	....
Motorcycles, set up	....	....	....	50	....	....	34	30	30	....	....	....
Motor trucks, 1½ tons	....	....	....	....	....	....	....	....	....	2	2	2
Motor trucks, 3 tons	....	....	....	....	....	....	....	....	....	2	2	2
Ponton and trestle wagons, engr. tn	....	....	....	....	....	....	....	....	....	1	1	1
Searchlight trucks, engr. tn	....	....	....	....	....	....	....	....	....	2	2	2
Engr. tn. units, except the above	....	....	....	....	....	....	....	....	....	3	3	3

[1] Officers. [2] Men.

371. *Locomotives* are of two general classes according to weight and the arrangement of driving wheels, viz, "Line power

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class" and "Yard and switch class." The line power class are generally from 100 to 250 tons weight, and include all models, from the "Mogul," 6 drivers, to the "Mallet," 12 drivers, and all are equipped with pilot and pony trucks and wheels. The yard and switch class are generally 100 tons weight or less, and usually have no pilot or pony trucks, although old line power locomotives are often transferred to yard and switch work, provided the wheel base is not too long. Roughly speaking, line power locomotives can haul six times their own weight on main-line track in average good condition, where grades do not exceed 2 per cent, and make an average running time of 25 miles per hour. The objection, in commercial practice, to putting passenger cars at the head of the train on account of increased risk does not apply with the same force to troop movements.

372. In cold weather the troop cars must be heated with steam from the locomotive and this is not possible where freight rolling stock is placed between the locomotive and the passenger cars.

373. Baggage cars fitted for kitchen each end, leaving center space 8 by 8 by 20 feet for rations, ammunition, or baggage, can be loaded to 12,000 pounds total weight with safety.

FACILITIES FOR ENTRAINMENT AND DETRAINMENT.

374. Rapid entrainment and detrainment require, as a primary condition, ample space of fairly level ground alongside of the railroad tracks for approach of troops and wagons to cars.

375. Commercial facilities for passenger and freight movement are seldom well fitted for troop movements for the reason that at railroad stations and terminals where adequate trackage exists the passenger and freight facilities are often at widely

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separated points, and at the larger terminals the freight and live-stock facilities are also separated.

376. Large car-storage yards, while they afford opportunity to collect the necessary rolling stock for a large troop movement, are generally of the "close-tracked" type and afford no proper space for approach to cars. (Pp. 78–87, Military Railways, 1916.)

377. Main-line tracks can not be used to advantage and would not often be available unless the railroad has been taken over entirely for troop movement. Even then this method would produce great delay in a large movement.

378. At large centers and railroad terminals the daily "loading and discharging yards" will be the best place for entrainment or detrainment, provided suitable means are installed for loading animals and vehicles. These can be provided in very short time in emergency.

379. At some centers the regular freight and live-stock yards and facilities can be used to best advantage and the trains subsequently made up of the various sections of passenger, freight, and stock equipment assigned to each train. Careful supervision of entrainment by this method will be necessary to prevent wrong assortment of trains.

380. Long sidings alongside of main tracks are advantageous provided the topography is favorable and approach to all parts of the train can be had simultaneously.

EXPEDIENTS IN EMERGENCY.

381. *Troops* can load and unload from passenger equipment at almost any point without reference to topographical conditions.

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382. *Freight, vehicles,* and *stock,* however, require some favorably located area where grade of surface is not below grade of track.

383. *Ordinary freight*—that is, in packages of less than 200 pounds to the piece—can be handled into or out of box cars either from or to ground stacks or directly from or to wagons. Some single-plank skids of 12 by 3 inches by 14 feet will be of great value in this work.

384. *Vehicles,* empty, can be skidded sideways on to or off flat cars. Loaded vehicles, including field artillery, must be rolled on, generally from the corner or the end of the car or from a platform, with ramp, alongside of car at car-floor level. A pair of double-plank skids—that is, two 12 by 3 inches by 16 feet, securely battened together, edge to edge—will afford easy means of rolling field artillery or loaded wagons from track level to car floor, provided a good support is placed at center of each skid. A single-plank skid is not sufficiently rigid and is also sure to cause delays by small lateral shifting necessitating readjustment before the load is up.

For loading of this nature a handy luff or gun tackle for 2-inch (circumference) rope is of great value.

385. *Animals* require a fairly secure ramp of some character for rapid loading or unloading. In appearance, stiffness, and grade the ramp should be such as to assure the animal of its security, otherwise much delay ensues. In the absence of regular stock chutes, four planks, 12 by 3 inches by 16 feet (or two of the double skids referred to for vehicles) will make a satisfactory ramp provided a good support is given at the center. The lower ends are buried to prevent slipping and two single planks are secured as side rails, the upper ends of which are at least 3 feet above the car floor.

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In emergency, unloading can be effected on the right of way of a double-tracked line by unloading onto the empty track, bracing the ramps against the outer rail. A quick method of supporting the center of ramps is to use two or three bales of hay or straw.

Ramps to unload stock can also be constructed quickly out of railroad ties so stacked as to provide a series of three or four sloping platform steps. Also, if nothing else is available, baled hay or straw can be stacked alongside the car and used as a ramp.

It would be well to provide all troop trains with 12 by 3 inch by 16 feet plank in proportion of six such planks to every three stock cars in the train (and at least six such planks to all trains), so that stock may be unloaded in emergency without great delay.

DISTINCTIVE MARKINGS.

386. A 5 by 8 inch placard is securely tacked to each side of every carload lot of supplies for identifying contents of cars, tracing and expediting movements so that any particular class of supplies can be readily located and given preference if desired. Such cards have distinctive colors and numerals, indicating the class and bureau to which the supplies belong. They bear provision for showing car initials and numbers, contents, point of shipment, consignee, destination, routing, date shipped, and consignor. The colors for various supplies are:

Medical, pink.
Signal, orange.
Engineer, red.
Ordnance, white.

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Quartermaster, buff, with bands as follows:

Subsistence, green.
Forage, blue.
Clothing and equipage, red.
General, white.

EXPLOSIVES AND MUNITIONS.

387. The Interstate Commerce Commission prescribes the regulations for the transportation of explosives, and these regulations should be consulted and carefully followed by those whose duty it is to arrange for such transportation. But all persons who may have to do with the handling of explosives should observe the following.

388. *Handling.*—In handling packages of explosives great care should be exercised to prevent shocks and falls to the containers.

Careful men should be chosen to handle explosives, the platform and feet of the men should be as free as possible from grit, and all precautions against fire should be taken. Safe storage room should be provided and the period of storage should be as short as possible.

Unauthorized persons must be kept away from the explosives.

389. *Loading in car.*—Packages receive their greatest stress in a direction parallel to the length of the car and must be loaded so as to offer their greatest resistance in that direction. Boxes of dangerous explosives must rest on their bottoms, the long dimension parallel to the length of the car.

390. A car must not contain more than 70,000 pounds gross weight of explosives. This does not apply to small-arms ammunition or ammunition for cannon.

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When the lading of a car includes explosives and exceeds 5,000 pounds, the weight of the lading must be distributed in approximately equal parts in both ends of the car. Explosives packed in kegs must be loaded on their sides with the ends toward ends of the car. Packages of explosives must not be placed in the space opposite the doors. Large casks, barrels, or drums must be loaded on their sides or ends.

391. Packages containing any of the explosives for the transportation of which a certified and placarded car is prescribed (for details see regulations) must be stayed (blocked or braced) by the one who loads the car, by methods not less efficient than those described in Bureau of Explosives Pamphlet No. 6, to prevent change of position by the ordinary shocks incident to transportation. Special care must be used to prevent them from falling to the floor or from having anything fall on them or slide against them during transit.

392. Shipments for different destinations must be stayed or secured separately.

393. Detonating fuses or blasting caps or electric blasting caps must not be loaded in a car or stored with high explosives of any kind, including explosive projectiles, nor with wet nitrocellulose.

394. Wet fulminate of mercury must not be loaded in the same car with dangerous explosives.

395. Explosives for which the placard "EXPLOSIVES" is required by the regulations must not be transported in a car with other explosives for which placards are required by the regulations.

396. When loading explosives and other freight in the same car both the explosives and the other freight must be stayed.

397. Leaking or damaged packages of explosives must not be shipped.

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398. Cars must be inspected to see that they are in proper condition. When a car loaded with explosives is being inspected at night electric or other suitable covered lights must be used. Naked lights are forbidden.

399. Cars to be placarded "explosives" must be box cars of not less than 60,000 pounds capacity with friction draft gear, equipped with air and hand brakes in good condition, must have no loose boards, cracks, etc., in roof, sides, or ends through which sparks may enter, doors must shut tightly, and if necessary must be stripped, journals in condition to reduce to minimum danger of hot boxes, lids of journals in place. Cars must be carefully swept and care taken that all projecting nails or other iron projections are removed or covered.

WATER TRANSPORT.

(Pars. 121 and 257, F. S. R., A. T. S. R.; 1914; Over-Sea Operations, Chap. III.)

400. The Army transport service is organized as a special branch of the Quartermaster Corps, United States Army, for the purpose of transporting troops and supplies by water.

401. Under war conditions, i. e., where ports of embarkation for the scene of intended hostilities have been established, the transport service at such ports will be under the supervision of the commander of the port of embarkation.

402. The commander of the port of embarkation, his staff and personnel are not subject to the orders of the commanding officer of troops at the concentration camp or the converse. Cordial cooperation between these commanders is essential to the efficient performance of their respective duties.

403. The commander of the port of embarkation prepares the schedules for the distribution and embarkation of the troops,

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matériel, and supplies on transports. The commander of the camp issues the orders necessary to carry out the schedules. Under all conditions these schedules will be made only after consultation with the commander of the troops involved.

404. When a landing or disembarkation in the face of opposition is anticipated, the distribution and plan of embarkation will be made to suit the tactical requirements of the situation, and in case of difference of opinion the final decision will rest with the commander of the troops.

405. When no opposition to landing is expected the final decision will rest with the commander of the port of embarkation.

406. Transports are fitted for the service for which intended, and are classified as:

(*a*) Troop transports.
(*b*) Animal transports.
(*c*) Cargo transports.
(*d*) Hospital ships.

GENERAL RULES.

407. Ordinarily the troops to form an expedition will be assembled in temporary camps near the port of embarkation several days before the probable date of sailing. When our fleet has control of the sea, and single transports may therefore carry reenforcements without escort, arrangements may be made to march the troops from the cars direct to the transports.

408. The order of embarkation of an army and its distribution on board ship will be governed by its tactical application on landing and the order in which its component parts will be required on shore. The probable order of disembarkation should therefore be determined beforehand. Provided space is not unduly sacrificed, units will be embarked complete with their

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animals and matériel, but if special rapidity of disembarkation is important, mounted troops should be divided up by troops, batteries, etc., amongst the transports instead of being conveyed in a few separate vessels.

409. On the day set for sailing, all camp equipage and baggage still in possession of the troops and required to be stowed on the transport will be conveyed to the wharf, accompanied by details of men to load this property and to guard it pending the arrival of the command.

410. Stores that will be required first on disembarking should be put on board last; the ammunition will be loaded first and put in the magazine, which will be locked and the key kept by the master. The property and baggage of each company should be stored separately as far as possible, and every article and package should be properly labeled.

411. Vehicles need not, as a rule, be knocked down, but should be hoisted aboard loaded. The height to which military vehicles should be loaded will in no case exceed 8 feet 6 inches from the ground. Poles of wagons should be lashed to them.

412. Aeroplanes may either be embarked in a partially dismantled condition or be completely dismantled and packed in boxes and treated as ordinary stores. The former method has the advantage of rapidity, but a special ship with open decks and large hatches should be provided for the purpose.

413. Commanding officers of organizations will supervise the loading of stores and animals for which they are responsible.

414. Departure from camp should be so timed that the whole command will be on board for the first meal which is served at the next regular meal hour after embarkation.

415. The command will be marched to the pier at convenient intervals, in such formations as the commanding officer of

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troops may direct. The first transport guard under command of its officer will march with the first battalion. Upon arrival at the pier the guard will be marched on board and will be immediately posted and instructed under the direction of the new officer of the day.

416. The assignment of quarters having been previously explained to company commanders, the command will then be marched on board by company, and each company will be conducted to its quarters; rifles will be placed in the racks and packs and equipment stowed in the proper places. To avoid confusion and to keep the gangways clear, all men not on duty will be held in their quarters until the whole command is embarked.

417. The men should be informed as to the location of the water supply, latrines, and wash rooms, and the rules as to their use.

418. After the command has embarked neither officers nor men will be allowed to leave the ship without authority of the commanding officer of troops.

419. No one shall go on the bridge except the commanding officer of troops and the authorized ship's officers and employees, and these only when their duties require it.

420. The men must be assigned to messes.

421. The men must be informed of the ship's orders and the ship's signals.

422. The following bugle calls will be used in addition to the routine calls:

Attention	Silence, every one to remain still.
Recall	Fall out.
Fire	Fire.
To arms	Collision; or, submarine attack.

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SHIP'S SIGNALS:

423. (*a*) Ship's bell rung violently, fire; (*b*) ship's bell rung quickly, followed by several short blasts on siren or whistle, collision. At these signals all buglers will sound the necessary calls. (*c*) Man overboard. At this call every man will remain quiet; those below will remain there.

TRANSPORTATION OF ANIMALS.

(Pars. 287–309, A. T. S. R., 1914.)

424. For the transportation of animals the transport service should be equipped with large steamers provided with bilge keels. The interior fittings should be of the most substantial character, the construction and arrangement of stalls being in accordance with approved plans on file in the office of the Quartermaster General.

425. Before loading the animals the quartermaster in charge should satisfy himself that ample forage and water are provided for the voyage; that the provisions for lighting and ventilation are satisfactory; that there is a sufficient number of attendants; that adequate veterinary supplies, disinfectants, and appliances for feeding, watering, grooming, and policing are on board, and that the ship is clean and sanitary.

426. All animals suffering from infectious or contagious disease and those which are weak or very old should be separated as unfit for embarkation.

427. For short voyages and immediate service upon landing the animals may be shod; but when the voyage is to occupy a month or more the shoes should be removed.

428. Animals should not be watered or fed for several hours before embarkation.

EMBARKATION.

429. With the transport at the wharf the animals are led on board on ramps, or they are hoisted by means of slings or

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flying stalls. The ramps, decks, etc., should be covered with sawdust or litter; the ramps should have closed sides 5 feet high. On reaching the stable deck the animals will at once be led to the farthest stalls, where a feed of hay should be ready for them.

430. When animals are slung, all the apparatus will be carefully inspected beforehand, and great care will be taken to prevent injury in hoisting or lowering. Timid or restive horses should be blindfolded.

431. When the transport can not come alongside a wharf the animals must be conveyed to it in lighters or flatboats and hoisted or led on board. To reach the lighters from shore, gangways or temporary platforms may be used.

432. Horses that are accustomed to each other should be put in contiguous stalls.

433. In rough weather, bags filled with anything soft will often preserve animals from injury.

TONNAGE TABLES.

434. *Gross tonnage* is the total cubic space below deck and the total cubic contents of closed spaces above deck.

Net tonnage is the gross tonnage minus all spaces not available for freight and after deducting accommodation for crew and space occupied by engine rooms, coal bunkers, etc.

Gross and net tonnage are figured at 100 cubic feet per ton.

Freight tonnage is a measure of cubic capacity, a freight ton being 40 cubic feet of cargo space.

435. In making calculations as to the gross tonnage required by a body of troops, 4 tons per man and 9 tons per animal and 10 tons per vehicle for ocean voyages should be allowed. For short voyages the above allowances for men and animals would be reduced as no fittings would be provided for the men, and only the simplest fittings, consistent with security, for the horses.

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436. As regards the tonnage required for guns, vehicles, etc., the stowage of such articles depends solely on clear deck or floor space, and all height above that of the vehicle is lost tonnage. In some ships the holds may be only just deep enough to take the highest vehicles, while in others there may be several feet to spare, yet only the same number of vehicles can be stowed in each.

437. CAPACITY OF NAVAL BOATS.

Boats.	Men.	Guns.	Vehicles.		Draft.
			4-wheel.	2-wheel.	
Motor sailing launch:					*Ft. in.*
30-foot	24	.....	.....	1	2 0
33-foot	50	.....	.....	1	2 6
36-foot	70	1	1	2	3 0
40-foot	90	1	1	2	3 6
50-foot	190	1	1	2	4 0
Steam launch:					
40-foot	29	.....	.....	.....	3 3
50-foot	44	.....	.....	.....	5 3

NOTE.—Naval ships are now supplied only with motor sailing launches and steamers.

FIELD TRANSPORT.

438. AVERAGE NET CARGOES.

Vehicles and functions.	Field supply ammunition, sanitary and engineer trains and columns.	Combat trains.	Pack mules.
	Pounds.	*Pounds.*	*Pounds.*
4-mule Army wagon	2,765	2,465	.....
Pack mules	.....	.....	250
Auto trucks, 1.5 tons	3,000	3,000	.....
Auto truck, 3-ton	6,000	6,000	.....

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439. Ammunition Carrying Capacity of Pack Mules and Vehicles.

Articles.	Weight each unit.		Number packed in box.	Space occupied by packing box.	Weight of box packed.
	Pounds.	Ounces.			
				Cu. in.	*Pounds.*
Ball cartridge, for United States magazine rifle, model of 1903 (in bandoleer) in metallic packing chest	.....	0.89	1,200	1,820	91.5
Ball cartridge, for United States magazine rifle, model of 1898 (in bandoleer)	.....	1.00	1,200	2,329	99.75
Ball cartridge, for United States magazine rifle, model of 1898	.....	1.00	1,000	1,914	79
Caliber .45 ball cartridges, for revolver and also for automatic pistol	.....	.80	2,000	2,099	120
Caliber .38 revolver ball cartridge	.....	.50	2,000	1,348	76
2.95-inch mountain gun, common steel shell, 18-pound, for pack outfit, assembled rounds	20	6.40	5	2,922	101.25
2.95-inch mountain gun, shell and shrapnel, 12.5-pound, for pack outfit, assembled rounds	15	.....	6	2,950	122
3-inch field gun, shrapnel, 15-pound, assembled rounds	19	6.00	4	3,736	106.5
3-inch field gun, steel shell, 15-pound, assembled rounds	18	14.00	4	3,769	106.5
3-inch field gun, cast-iron shell, 15-pound, assembled rounds	19	14.00	4	3,324	107
3.8-inch howitzer, high explosive steel shell, or shrapnel, 30-pound, assembled rounds	34	8.00	2	1,265	89
4.7-inch gun, high explosive steel shell, or shrapnel, 60-pound, assembled rounds	73	8.00	1	2,184	93.5
4.7-inch howitzer, high explosive steel shell or shrapnel, 60-pound, assembled rounds	67	.....	1	1,963	87
5-inch gun, cast-iron shell, 45-pound, assembled rounds	45	8.00	2	3,827	138.5
6-inch howitzer, high explosive steel shell or shrapnel, 120-pound, assembled rounds	132	.....	1	4,586	162
7-inch siege howitzer, shrapnel, 105-pound, filled and fused, assembled rounds	105	8.00	1	2,730	130.5
7-inch siege howitzer, cast-iron shell, 105-pound, assembled rounds	105	.....	1	3,037	131

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AMMUNITION CARRYING CAPACITY OF PACK MULES AND VEHICLES—Continued.

Articles.	Carrying capacity of—			
	Pack mule.	Army wagon.	Auto-truck.	Caisson with limber.
Ball cartridge, for United States magazine rifle, model of 1903 (in bandoleer) in metallic packing chest	*Rounds.* 2,400	*Rounds.* 36,000	*Rounds.* 39,600	*Rounds.* .....
Ball cartridge, for United States magazine rifle, model of 1898 (in bandoleer)	4,000	33,600	36,000	.....
Ball cartridge, for United States magazine rifle, model of 1898	3,000	35,000	38,000	.....
Caliber .45 ball cartridges, for revolver and also for automatic pistol	4,000	46,000	50,000	.....
Caliber .38 revolver ball cartridge	6,000	72,000	78,000	.....
2.95-inch mountain gun, common steel shell, 18-pound, for pack outfit, assembled rounds	10	135	150	.....
2.95-inch mountain gun, shell and shrapnel, 12.5-pound, for pack outfit, assembled rounds	10	132	150	.....
3-inch field gun, shrapnel, 15-pound, assembled rounds	.....	104	112	106
3-inch field gun, steel shell, 15-pound, assembled rounds	.....	104	112	106
3-inch field gun, cast-iron shell, 15-pound, assembled rounds	.....	104	112	106
3.8-inch howitzer, high explosive steel shell, or shrapnel, 30-pound, assembled rounds	.....	62	68	48
4.7-inch gun, high explosive steel shell, or shrapnel, 60-pound, assembled rounds	.....	30	32	56
4.7-inch howitzer, high explosive steel shell or shrapnel, 60-pound, assembled rounds	.....	32	34	30
5-inch gun, cast-iron shell, 45-pound, assembled rounds	.....	40	44	.....
6-inch howitzer, high explosive steel shell or shrapnel, 120-pound, assembled rounds	.....	17	18	28
7-inch siege howitzer, shrapnel, 105-pound, filled and fused, assembled rounds	.....	21	23	.....
7-inch siege howitzer, cast-iron shell, 105-pound, assembled rounds	.....	21	23	.....

NOTE.—In determining the loads of pack mule and army wagon, it was assumed that the ammunition would be carried in original packing boxes, except as to mountain artillery ammunition, which is held in special carriers on pack mule.

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440. BAGGAGE.

	A. Tentage.		B.	C.	D.
	Small pyramidal tents.	Shelter tents, complete.	Messing and cooking outfits.	Officers' bedding and clothing rolls.	Records and all other requisites.
1. Headquarters of a corps or army (as prescribed by commander).	*Number.*	*Number.*	*Pounds.*	*Pounds.*	*Pounds.*
2. Headquarters of a division or brigade			100		800
For personal use and office of—					
(*a*) Commander	1			100	
(*b*) Every two staff officers	1			100	
3. Regiment:					
Artillery					2,000
Infantry					2,500
Cavalry					7,000
(*a*) Each field officer	1			50	
(*b*) Each captain, lieutenant, and veterinarian		1		50	
(*c*) Each company, troop, battery, and band, per man			[1] 1		
4. Independent battalion					500
(*a*) Each field officer	1			50	
(*b*) Each captain, lieutenant, and veterinarian		1		50	
(*c*) Each company, troop, or battery, per man			[1] 1		
5. A supply, ammunition, sanitary, or engineer train and column					300
(*a*) Every two field officers	1			100	
(*b*) Each captain, lieutenant, and veterinarian		1		50	
(*c*) For every 100 men of train personnel			100		

[1] The minimum allowance for any company, troop, battery, or band mess being 50 pounds.

NOTE.—Each enlisted man and attached civilian employee carries a shelter-tent half.

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441. NOTE.—Table 3–C,. Tables of Organization, 1914, prescribes the allowance of tentage for officers, and fixes the weight limit of their other baggage at 100 pounds for each general officer and at 50 pounds for each remaining officer. The following articles may be taken without exceeding a weight limit of 50 pounds:

	Lbs.	oz.
1 bag, barrack	1	0
1 bar, mosquito		14
1 basin, canvas		7
1 bedding roll, canvas [1]	11	12
1 bedsack	1	14
1 blanket, olive drab	5	2
1 bucket, canvas, 12-quart	2	0
Clothing:		
1 breeches, woolen, olive drab, pair	1	9
3 drawers, cotton, pair	1	11
1 laces, shoe, extra, pair.		
1 shirt, flannel, olive drab		15
1 shoes, marching, pair	2	10
5 stockings, light woolen, pair		10
3 undershirts, cotton	1	8
1 clothing roll, canvas [1]	3	14
3 handkerchiefs		2
1 headnet, mosquito		14
1 lantern, combination (or a folding lantern)	2	4
1 pack carrier		8
1 poncho (for dismounted officers only)	3	13
1 slicker (for mounted officers only; carried on mount).		
1 sweater	2	0

[1] The bedding roll adopted by the Quartermaster Corps or any other canvas roll may be used as a combination bedding-clothing roll (U. R.).

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Toilet articles:	Lbs.	oz.
1 comb		2
1 housewife		4
1 mirror		6
1 paper, toilet, package		15
1 shaving outfit, and materials	1	4
1 soap, cake		6
1 toothbrush and dentifrice		4
3 towels, face	1	0
Total	50	0

The foregoing tables do not include the articles for a winter campaign, when climatic conditions make it necessary to have additional clothing, tentage, stoves, equipment, etc. Such conditions require that additional vehicles be temporarily attached to the baggage section of field trains. The organizations are presumed to be integral parts of a division on the march in the theater of operations, and at their maximum war strength. Organizations detached for independent action require additional transportation as stated on page 4, Tables of Organization, 1914. Unless stated otherwise in the tables, the quantities of expendable supplies, as shown therein, are deemed sufficient for a 10-day period. The loads shown are greater than need be carried under normal conditions of supply inasmuch as, ordinarily, less than 10 days' supply of such articles as soap, lantern candles (or mineral oil), rock salt, etc., will be carried, because these articles can be replenished with the same facility as rations. As a rule, the loads will be further reduced by one meal of rations and grain consumed before starting on a march.

Surplus kits do not accompany troops on the march in the theater of operations; but, if the length of a halt is of some considerable duration, these kits are temporarily placed at the

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disposition of organizations if practicable (F. S. R. 237). When the troops are actually engaged in field operations, each enlisted man should carry, on his person or mount, a change of underclothing (drawers, shirt, and stockings). The divisional supply train maintains, in addition to rations and grain, 32 tons, or such amount thereof as may be necessary, of reserve supplies, including clothing, for the use of the entire division.

442. CONVERSION TABLES.

The figures in the central columns refer to either side; e. g., in the first column the first line means that 1 inch=2.5399 centimeters, or that 1 centimeter=.39 inch.

Centimeters.	*	Inches.	Meters.		Feet.	Meters.		Yards.
2.5399	1	0.39	0.305	1	3.281	0.914	1	1.093
5.0799	2	.79	.609	2	6.562	1.829	2	2.187
7.6199	3	1.18	.914	3	9.843	2.743	3	3.281
10.1598	4	1.57	1.219	4	13.124	3.658	4	4.374
12.6998	5	1.97	1.524	5	16.405	4.572	5	5.468
15.2397	6	2.36	1.829	6	19.685	5.486	6	6.562
17.7797	7	2.75	2.133	7	22.966	6.401	7	7.655
20.3196	8	3.15	2.438	8	26.247	7.315	8	8.749
22.8596	9	3.54	2.743	9	29.528	8.229	9	9.843
25.3995	10	3.94	3.048	10	32.809	9.144	10	10.936
38.0993	15	5.90	4.572	15	49.214	13.816	15	16.404
50.7990	20	7.87	6.096	20	65.618	18.288	20	21.873
76.1985	30	11.81	9.144	30	98.427	27.432	30	32.809
101.5980	40	15.75	12.192	40	131.236	36.576	40	43.745
126.9975	50	19.68	15.239	50	164.045	45.719	50	54.682
152.3971	60	23.62	18.287	60	196.854	54.863	60	65.618
177.7966	70	27.56	21.335	70	229.663	64.007	70	76.554
203.1961	80	31.50	24.383	80	262.472	73.151	80	87.491
228.5956	90	35.43	27.431	90	295.281	82.295	90	98.427
253.9951	100	39.37	30.479	100	328.090	91.438	100	109.363

*In order to bring millimeters to inches, shift the point one to the left. In order to bring inches to millimeters, shift the point one to the right, e. g., 9 millimeters=.354 inches; 9 inches=228.59 millimeters.

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Kilometers.		Miles.	Hectares.		Acres.	Liters.		Gallons.
1.609	1	.621	.405	1	2.471	4.543	1	.220
3.219	2	1.243	.809	2	4.942	9.087	2	.440
4.828	3	1.864	1.214	3	7.413	13.630	3	.660
6.438	4	2.486	1.619	4	9.884	18.174	4	.880
8.047	5	3.107	2.024	5	12.356	22.717	5	1.110
9.656	6	3.728	2.428	6	14.827	27.261	6	1.321
11.265	7	4.350	2.833	7	17.298	31.804	7	1.541
12.879	8	4.971	3.238	8	19.769	36.348	8	1.761
14.484	9	5.592	3.642	9	22.240	40.891	9	1.981
16.093	10	6.214	4.047	10	24.711	45.435	10	2.201
24.140	15	9.321	6.070	15	37.066	68.152	15	3.311
32.186	20	12.428	8.094	20	49.422	90.869	20	4.402
48.279	30	18.641	12.141	30	74.133	136.304	30	6.603
61.373	40	24.855	16.188	40	98.844	181.738	40	8.804
80.466	50	31.069	20.235	50	123.555	227.173	50	11.105
96.559	60	37.283	24.282	60	148.266	272.607	60	13.206
112.652	70	43.497	28.329	70	172.977	318.042	70	15.407
128.746	80	49.710	32.376	80	197.688	363.477	80	17.608
144.839	90	55.924	36.423	90	222.399	408.911	90	19.809
160.932	100	62.138	40.468	100	247.108	454.346	100	22.010

Kilograms.		Pounds.	Kilograms.		Pounds.	Kilograms.		Pounds.
.454	1	2.205	3.629	8	17.637	22.679	50	110.231
.907	2	4.409	4.082	9	19.841	27.215	60	132.228
1.361	3	6.614	4.536	10	22.046	31.751	70	154.322
1.814	4	8.818	6.804	15	33.069	36.287	80	176.369
2.268	5	11.023	9.072	20	44.092	40.823	90	198.416
2.721	6	13.228	13.608	30	66.139	45.359	110	220.462
3.175	7	15.432	18.144	40	88.185			

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443. SOME DISTANCES (BETWEEN TOWNS AS THE CROW FLIES).

	Miles.		Miles.
London–Paris	206	Russian frontier [1]–Berlin	180
Dover–Calais	26	Harwich–Cuxhaven	335
Folkestone–Boulogne	30	Yarmouth–Wilhelmshaven	270
Paris–Calais	143	Petrograd–Prussian frontier [1]	445
Paris–Boulogne	132	Hazebrouck–Armentieres	16
Paris–Amiens	70	Calais–Amiens	76
Boulogne–Hazebrouck	40	Length of Holland seaboard [2]	250
Amiens–Lille	62	Length of (North Sea) German seaboard [2]	150
Paris–Lille	123	Lille–Aix-la-Chapelle	130
Length of Belgian seaboard	40	Paris–Coblenz	250
Dover–Ostend	63	Paris–Mainz	265
Ostend–Brussels	70	Length of Franco-German frontier	170
Paris–Mons	130	Length of Franco-Belgian frontier	270
Paris–Rheims	81	Salonika–Nish	248
Paris–Belfort	220	Salonika–Constantinople	318
Paris–Metz	170	Dedeagach–Adrianople	67
Paris–Soissons	57	Alexandria–Cairo	165
Paris–Brussels	163	Ismailia–Cairo	72
Brussels–Antwerp	25	Constantinople–Alexandria	658
London–Berlin	570		
Paris–Berlin	550		
Metz–Berlin	400		

[1] Nearest point.

[2] Not including indentations.

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CHAPTER VI.

SMALL ARMS AND GUNS.

444. ***United States rifle, caliber .30:***

Weight without bayonet, 8 pounds 11 ounces.
Weight with bayonet, 9 pounds 11 ounces.
Length without bayonet, 3 feet 7¼ inches.
Length with bayonet, 4 feet 10¾ inches.
Rifling, one turn in 10 inches.
Maximum range, 4,291.6 yards.
Sighted to 2,850 yards.

Ammunition:

Cartridge, weight, 395.5 grains.
Bullet, lead core, cupro nickel jacket.
Bullet, weight, 150 grains.
Bullet, length, 1.095 inches.
Powder charge, about 50 grains.
Initial velocity, 2,700 foot-seconds.
Powder pressure, about 51,000 pounds per square inch.
Clip holds 5 rounds.
Bandoleer holds 60 rounds.
Bandoleer weighs 3 pounds 14.5 ounces.
Ammunition boxes hold 1,200 rounds, in bandoleers.
Ammunition boxes weigh 99 pounds.

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445. *United States pistol, automatic, caliber .45:*

Weight, 2 pounds 7 ounces.
Length, 8.6 inches.
Initial velocity, 800 foot-seconds.
Extreme range, 1,955 yards, approximately.
Magazine contains 7 rounds.

Ammunition:

Bullet weighs 230 grains.
Bullet, length, 0.66 inch.
Weight of 100 cartridges, 4.6 pounds.
Number rounds in box, 2,000.
Weight of box, packed, 110 pounds.
Length of cartridge, 1.26 inches.

446. *Notes on the use of the rifle.*—Danger space decreases as the range increases. Extent of danger space depends upon (*a*) firer's position, (*b*) height of object fired at, (*c*) flatness of trajectory, (*d*) conformation of ground.

The nearer the rifle is to the ground,
The greater the height of the object fired at,
The flatter the trajectory,
The more nearly the ground conforms to the angle of fall of the bullet,
} the greater the danger space.

With the bayonet fixed a slightly greater elevation is required, about 50 yards at 600 yards.

Using fixed rest the rifle shoots slightly higher.

447. More elevation is required when temperature is cool. Less elevation is required (*a*) when temperature is hot, (*b*) high above sea level, (*c*) firing up or down hill.

448. Rifle is sighted for (*a*) barometric pressure of 30 inches, (*b*) temperature of 70° F., (*c*) still air.

449. Objects seem near when (*a*) the object is in a bright light, (*b*) the color of the object contrasts sharply with the

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color of the background, (*c*) looking over water, snow, or a uniform surface like a wheat field, (*d*) in the clear atmosphere of high altitudes, (*e*) looking from a height downward.

450. Objects seem more distant when (*a*) looking over a depression in the ground, (*b*) there is a poor light or fog, (*c*) only a small part of the object can be seen, (*d*) looking from low ground upward toward higher ground.

CLEANING RIFLE.

451. In cleaning the bore after firing it is well to proceed as follows: Swab out the bore with soda solution (see below) to remove powder fouling. A convenient method is to insert the muzzle of the rifle into the can containing the soda solution and with the cleaning rod inserted from the breech, pump the barrel full a few times. Remove and dry with a couple of patches. Examine the bore to see that there are in evidence no patches of metal fouling which, if present, can be readily detected by the naked eye, then swab out with the swabbing solution—a dilute metal-fouling solution. Dry thoroughly and oil. The proper method of oiling a barrel is as follows: Wipe the cleaning rod dry; select a clean patch and thoroughly saturate it with sperm oil or warmed cosmic, being sure that the cosmic has penetrated the patch; scrub the bore with the patch, finally drawing the patch smoothly from the muzzle to the breech, allowing the cleaning rod to turn with the rifling. The bore will be found now to be smooth and bright, so that any subsequent rust and sweating can be easily detected by inspection. If the swabbing solution or the standard metal-fouling solution is not available, the barrel should be scrubbed, as already described, with the soda solution, dried, and oiled with a light oil. At the end of 24 hours it should be again cleaned, when it will usually be found to have

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"sweated"; that is, rust having formed under the smear of metal fouling where powder fouling was present, the surface is puffed up. Usually a second cleaning is sufficient, but to insure safety it should be again examined at the end of a few days, before final oiling. The swabbing solution should always be used, if available, for it must be remembered that each puff when the bore "sweats" is an incipient rust pit.

PREPARATION OF SOLUTIONS.

452. *Soda solution.*—This should be a saturated solution of sal soda (bicarbonate of soda). A strength of at least 20 per cent is necessary. The spoon referred to in the following directions is the model 1910 spoon issued in the mess outfit.

Sal soda, one-fourth pound, or four heaping spoonfuls.

Water, 1 pint or cup, model of 1910, to upper rivets.

The sal soda will dissolve more readily in hot water.

Swabbing solution.—Ammonium persulphate, 60 grains, one-half spoonful smoothed off. Ammonia, 28 per cent, 6 ounces, or three-eighths of a pint, or 12 spoonfuls. Water, 4 ounces, or one-fourth pint, or 8 spoonfuls. Dissolve the ammonium persulphate in the water and add the ammonia. Keep in tightly corked bottle; pour out only what is necessary at the time, and keep the bottle corked.

Standard metal-fouling solution.—Ammonium persulphate, 1 ounce, or 2 medium heaping spoonfuls. Ammonium carbonate, 200 grains, or 1 heaping spoonful. Ammonia, 28 per cent, 6 ounces, or three-eighths pint, or 12 spoonfuls. Water, 4 ounces, or one-fourth pint, or 8 spoonfuls. Powder the persulphate and carbonate together, dissolve in the water and add the ammonia; mix thoroughly and allow to stand for one hour before using. It should be kept in a strong bottle, tightly corked. The solu-

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tion should not be used more than twice, and used solution should not be mixed with unused solution, but should be bottled separately. The solution when mixed should be used within 30 days. Care should be exercised in mixing and using this solution to prevent injury to the rifle.

453. FIELD GUNS AND HOWITZERS.

	2.95-inch mountain gun.	3-inch rifle.	3.8-inch howitzer.	4.7-inch rifle.	6-inch howitzer.
Muzzle velocity.....foot-seconds..	920	1,700	900	1,700	900
Caliber.....	2.953	3.0	3.8	4.7	6.0
Weight of projectile.....pounds..	12.5	15	30	60	120
Number of rounds per gun:					
With firing battery[1].....	50	190	96	84	42
With C. tr.....	55	168	72	84	42
With am. tr.[2].....	60	106	264	168	84
Maximum range.....yards..	5,000	7,500	6,338	11,000	6,704
Weight of—					
Gun and carriage.....pounds..	830	2,520	2,040	7,420	7,248
Gun, carriage, and limber.....do....	.....	4,212	3,970	8,783	8,611
Width of track, center to center....feet..	[3] 32	5	5	5	5

[1] Consists of four gun sections and fifth section.

[2] To replace ammunition used in combat an amount not less than that carried by mobile force is kept in ammunition columns near advance base. And additional similar amount is maintained at the base.

[3] Inches.

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454. Small-Arms Ammunition Carried in the Field.

	Infantry.	Cavalry.	Artillery.[1]	Engineers.	Signal troops.[2]
Rounds per rifle:					
In belt	100	90	.....	80	.....
In combat train	120	130	.....	120	.....
In ammunition train	220	220	.....	220	.....
Rounds per pistol:[3]					
In belt	21	21	21	21	21
In combat train	21	21	21	.....	.....
In ammunition train	7	7	7	7	7
For each machine gun:					
On mules	[4] 6,250 [5] 4,800	[4] 6,250 [5] 4,800	.....	.....	.....
In combat train	11,200	11,200	.....	.....	.....
In ammunition train	12,850	12,850	.....	.....	.....

[1] Light, heavy, horse, and mountain artillery.
[2] Signal troops requiring ammunition draw from the nearest ammunition wagon.
[3] If revolver is carried, number of rounds is 20.
[4] Maxim machine gun.
[5] Automatic machine gun.

Note.—1. To replace ammunition used in combat an amount not less than that carried by the mobile forces is kept in ammunition columns near advance depot and an additional similar amount is maintained at the base.

2. For the purpose of arriving approximately at the number of rounds to be carried in ammunition trains, the number of rifles in units is calculated as: Infantry regiment, 1,800; cavalry regiment, 1,300; engineer regiment, 950. The number of pistols is: Infantry regiment, 250; cavalry regiment, 1,500; artillery regiment, 1,300; engineer regiment, 325.

3. Capacity in rounds per vehicle and animal is approximately: Rifle ammunition—mules, 2,400; wagons, 35,000; trucks, 36,000. Pistol ammunition—mules, 4,000, wagons, 46,000; trucks, 50,000.

455. British rifle (S. M. L. E.):

Caliber, 0.303 inch.

Length, 3 feet 8½ inches.

Weight, 8 pounds 1 ounce to 9 pounds.

Length of barrel, 2 feet 1¼ inches.

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Length of rifle with bayonet fixed, 5 feet 2 inches.
Length of bayonet, 1 foot 10 inches.
Length of bayonet blade only, 1 foot 5⅛ inches.
Weight of bayonet, 1 pound ½ ounce.
Weight of 5 rounds (in charger), 5 ounces.
Weight of box of ammunition, 20 bandoleers at 50 rounds = 1,000 rounds (75 pounds).
Dimensions of box of ammunition, 8.3 by 10.9 by 17 inches.

456. British service revolver, caliber, .441 inch.
Dimensions of a sand bag (empty), 2 feet 9 inches by 1 foot 2 inches.
Dimensions of a sand bag (full), 20 by 10 by 5 inches.
Length of rifle cartridge, 3.05 inches; weight 386 grains.
Bullet, length, 1.28 inches; weight, 174 grains; charge, 39 grains; I. V., 2,440 feet per second.

MISCELLANEOUS.

457. Height of wheel (British gun or wagon), 4 feet 8 inches; width between wheelmarks of British gun or wagon, 5 feet 2 inches; clearance, 6 feet 3 inches; Maxim gun (Mark III), weighs 60 pounds; Maxim gun (Mark IV), weighs 28½ pounds, besides 10 pounds of water in casing. Weight of tripod, 48 pounds; of ammunition box containing 1 filled belt (250), 21 pounds.

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458. SOME DETAILS OF BRITISH FIELD ARTILLERY.

	13-pounder q. f.	18-pounder q. f.	60-pounder b. l.	4.5-inch howitzer.	5-inch howitzer.
Caliber	3	3.3	5	4.5	5
Weight of projectile...pounds..	12½	18½	60	35	50
Rounds in limber	24	24	2	12	16
Rounds in wagon	38	38	26	32	32
Rounds in wagon limber	38	38	12	16	16
Weight of gun and carriage [1] ...pounds..	2,240	2,800	10,200	3,025	2,690
Length of gun and carriage	12′ 2″	13′ 8″	21′ 7″	12′ 3″	9′ 2½″
Weight of gun, carriage, and limber [1].....pounds..	3,700	4,540	13,000	4,700	4,800

[1] Approximate.

459. The German Mauser rifle is of 7.9 mm. caliber (0.311 inch) and is sighted to 2,200 yards, five rounds in a clip. The length is 4 feet 1½ inches without and 5 feet 9¾ inches with bayonet.

Weight of rifle, 9 pounds.

460. GERMAN FIELD AND HEAVY ARTILLERY.

	'96, 7.7 c. m. field gun.	'98, 10.5 c. m. field howitzer.	10 c. m. Q. F. gun.	13 c. m. gun.	'13, 15 c. m. field howitzer.	15 c. m. long gun.	21 c. m. mortar.	28 c. m. howitzer.	42 c. m. howitzer.[1]
Muzzle velocity.....feet..	1,525	985	1,980	2,280	905	1,640	996	1,115	(?)
Caliber.....inches..	3.03	4.13	4.13	5.31	5.90	5.90	8.30	11.02	16.54
Weight of projectile.pounds..	15	34	40	88	89	88	262	750	2,090
Maximum range.....yards..	9,200	7,600	11,300	15,800	9,300	11,000	10,300	12,000	(?)[2]
Weight of gun and carriage .....pounds..	3,975	4,145	7,730	(?)	4,815	14,335	10,865	[3] 13½	[3] 110

[1] There are very few of these (? 8) and their range is problematical.
[2] 22 miles.
[3] Tons.

N. B.—Bz on German fuses, etc.=time fuse (Brennzunder); Az on German fuses, etc.=percussion fuse (Aufschlagzunder).

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There is also an old pattern 12 c. m. gun with a range of 8,000 yards. The heavy German Minenwerfer throws 460 yards, the light types 875 and 1,150 yards, respectively.

461. The French rifle is the Lebel of 8 mm. caliber (0.315 inch) and is sighted to 2,200 yards, carries 8 rounds in tube fore end. The length is 4 feet 3 inches without and 6 feet with (triangular) bayonet. Weight of rifle, 9 pounds 3 ounces.

462. FRENCH FIELD AND HEAVY ARTILLERY.

	75 mm. field gun.	105 mm. quick-firing gun.	155 mm. quick-firing gun.
Muzzle velocity....feet..	1,736	1,886	984
Caliber....inches..	2.95	4.13	6.1
Weight of projectile....pounds..	16	35½	90
Maximum range....yards..	9,300	12,900	7,000
Weight of gun and carriage....pounds..	2,130	5,375	6,215

SUPPLY OF AMMUNITION IN THE FIELD.

(Part III, Art. IV, p. 132, F.S.R.)

463. The work of replenishing ammunition is divided between—

(*a*) Units working under the commander of the line of communications.

(*b*) Units working under the division commander.

464. The general system of ammunition supply is as follows:

(*a*) The men and guns in the fighting line carry with them a certain amount of ammunition.

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(*b*) The regimental reserve supply of ammunition is carried on combat wagons or mules. Ammunition expended in the firing line is replaced from this source. These combat trains are in turn usually filled from the ammunition trains of the division, though in certain instances they may be filled direct from the line of communication or from ammunition columns.

(*c*) The divisional ammunition trains are operated under the divisional artillery commander, after release from the control of the commander of trains. These trains are divided into two sections, viz., a small arms section consisting of six wagon companies carrying 5,395,000 rounds of rifle ammunition and 180,000 rounds of pistol ammunition; an artillery section consisting of six wagon companies, of which two wagon companies are used for 3-inch ammunition, 5,064 rounds, and four wagon companies are used for 3.8-inch ammunition, 6,534 rounds.

The ammunition trains are usually filled from the ammunition columns though they may in certain instances fill direct from the line of communication.

(*d*) The ammunition columns operate from the line of communications. It is the function of the ammunition columns to push up close to the troops so as to shorten the haul of the ammunition trains and to keep a constant supply of ammunition at the refilling point.

It is the function of the organizations to which are attached combat trains to regulate the supply of ammunition to the front and to insure the dispatching of empty combat wagons to the distributing station.

The commander of the ammunition trains must keep himself informed, by means of agents, of the probable future needs of troops at the front and make early arrangements for the establishment of distributing stations (if not otherwise designated)

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and for investigating the best lines of approach. These distributing stations are usually about 2 or 3 miles from the line of battle. Empty vehicles must be promptly replaced, sent to the refilling point, fill, and join the filled vehicles.

Ammunition-train commanders comply with demands for ammunition from troops of other commands, provided their own troops can spare it. This applies particularly to independent cavalry.

During an action or when action is imminent the commander of the line of communications will send forward ammunition columns to rendezvous points for later dispatch to refilling points as occasion may demand.

(See diagram, p. 133, F.S.R.)

CARE AND PRESERVATION OF AMMUNITION AND EXPLOSIVES.

465. For the purpose of storage, ammunition is divided into **five classes:**

(*a*) Ammunition for mountain, field and siege guns, and howitzers.

(*b*) Trench munitions (explosive bombs and grenades).

(*c*) Miscellaneous munitions (incendiary and smoke munitions, rockets, flares, etc.). Incendiary and smoke munitions should be in stacks separated from each other as far as possible in the area and should be separately transported.

(*d*) Mining or demolition explosives (gunpowder, gun cotton, dynamite, Jovite, Triton, etc.).

(*e*) Small-arms ammunition.

466. In large depots each of the above classes should be stored at a distance of at least 400 yards from other classes. Even in ammunition dumps class (*c*) should be stored separately owing to its liability to take fire.

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467. *Field artillery ammunition.*—In all field artillery guns up to the 4.7-inch fixed ammunition is used, all shrapnel fuzed, and all shell filled and fuzed. The element of danger of accidental arming of fuzes has been practically eliminated, and the danger from accidental burst through the "time feature" is negligible if the fuze is set at "safety." The upper powder train may burn entirely out in case of accidental firing of the time plunger without the flame being able to reach the magazine of the fuze.

Primers are assembled with the cartridge cases.

Field artillery howitzers and siege guns use separate loading.

468. *Grenades.*—The rifle grenade adopted by the Ordnance Department is that known as the Babbitt rifle grenade. This grenade is intended to be fired from a service magazine rifle, model 1903, by a specially loaded blank cartridge.

469. The hand grenade, as well as the rifle grenade, is assembled with primer. They are rendered inert during transportation and until ready for use by the safety cup in the case of the hand grenade and by the safety pin in case of the rifle grenade.

470. Live grenades should be handled with the greatest care, and should not be used until practice has been had with dummies. At practice or in combat all grenades which have failed to function should be destroyed by throwing them into a deep stream or by burying them deep in the ground. In handling the hand grenades always hold same by the body and not by rope or streamer.

471. In firing the rifle grenade all persons about the firing point should take cover before grenade strikes the ground as the stem is sometimes thrown several hundred yards to the rear with sufficient force to inflict a dangerous if not fatal

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wound. If a rifle grenade fails to function it should be picked up and carried with stem pointing downward and placed in a deep stream or buried. A grenade which has failed should not be fired again.

472. The safety wire of the rifle grenade is not to be removed until the stem of the grenade is inserted in the rifle.

473. The safety cup is not to be removed from the hand grenade until it is about to be thrown.

474. *Rockets, flares, etc.*—Some of the rockets, flares, bombs, grenades, etc., contain phosphorus. This chemical, if dry, ignites spontaneously when exposed to the air. Water should be kept conveniently near storage places of these articles. They should not be exposed to the direct rays of the sun and should be stored in a cool place.

Phosphorus bombs and grenades are largely used in foreign armies.

475. *Mines.*—In the preparation of land mines and counter mining operations commercial explosives would be used, and the following notes on care and storage should be observed.

Commercial detonators are supplied in boxes of 50 each and should be stored in a cool, dry place, separate from any explosives.

Detonators will be handled by the bodies and not by the wires.

Dynamite cartridges are ordinarily packed in sawdust in wooden boxes; each cartridge is wrapped separately in paraffin paper.

The boxes must be stored so the cartridges will be horizontal. Cartridges should be kept dry by storing boxes in a dry place, raised from the ground or floor on skids.

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The danger from dynamite in storage is from the exudation or leaking of the nitroglycerin; this may be detected by inspection for small white, oily, lustrous globules on the sticks or paper wrapper. Report to an ordance officer, who will apply tests for deterioration and take proper action.

Guncotton should be kept wet in storage; 15 pounds of water to 100 pounds of guncotton. It may be detonated by use of a small amount of dry guncotton and a detonator.

Black powder should not be stored with other explosives.

Jovite is an American powder coming into favor. It is safe and reliable and is unaffected by heat, cold, or concussion. Ordinary precautions will be taken in its storage.

476. *Poison gas and lachrymal shell.*—The danger to be met in handling these shells is from possible leakage or from accidental burst. A leak may always be detected by the odor or by the effect produced upon the eyes.

All persons handling these shells, either at depots or at the front, should carry the gas helmet ready for use.

If a leak is suspected it should immediately be reported, and all men working in the vicinity should at once put on their gas helmets.

Leaking shell must be buried in the ground at least 3½ feet and covered with lime before filling in hole with earth. They must not be thrown in water on account of danger of poisoning same.

477. Small-arm ammunition may be stored in any area.

478. Stocks of ammunition should not be situated in the vicinity of main roads or inhabited buildings, nor should they be on railway premises where the effect of explosions would be liable to damage the main line. Single sheds or shelters or groups of small shelters should not exceed 30 by 200 to 300 feet, and should not be less than 200 yards apart; if they are

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traversed this distance may be reduced to 100 yards. Dumps of ammunition should be regarded as sheds in determining distances.

479. Sheds are not necessary for medium or heavy shells, but it is desirable that they be protected from the direct rays of the sun. If overhead splinter-proof is not provided, this protection can be afforded by paulins stretched over light wooden framework. Where floor space admits, heavy shells should be stood on end.

Wooden sheds may be used, but iron sheds are preferred. They should not be higher than necessary and the roof should be of corrugated iron. Where, however, overhead splinter-proof cover is water-tight, it is unnecessary to provide a roof above this.

Curved corrugated iron shelters, covered by sand-bag arching, are a suitable form of construction.

Sheds should be subdivided by traverses up to the roof as necessary. The ends should always be traversed if the sheds are end on to each other.

480. Splinter-proof overhead cover should be provided at ammunition stores for all kinds of ammunition when possible, and especially for boxed gun ammunition. The object is not only to guard against light high-explosive bombs and incendiary bombs dropped by hostile aircraft, but more especially to afford protection from shell and fragments projected from a neighboring burning shed.

481. All ammunition stores should be inclosed by a fence and should be under charge of a guard, who should not live in the store.

482. Any building intended to be used for the storage of ammunition should be inspected by a qualified ordnance officer, who should furnish a report on its suitability.

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483. An officer should be in charge of every store or dump of ammunition, who should be made responsible for all arrangements in connection with its safe custody and storage, and that all reasonable precautions are taken to guard against accident or deterioration.

484. *Blank ammunition.*—Blank metallic ammunition is used in salute firing and in maneuver exercises, and consists of a brass cartridge case, a percussion primer, a charge of black powder (1½ pounds in a 3-inch gun), and a tight-fitting felt wad.

Cartridge cases are issued unprimed, and primers should not be inserted until the ammunition is to be prepared for use. Under no circumstances will a primer be inserted after the powder charge has been placed in the cartridge case. The primer should be a tight fit and must be pressed into place by the primer inserting press, and must not be hammered in.

Blank metallic ammunition will be assembled under the personal supervision of a commissioned officer.

Cartridge cases will be tested in gun to see if they fit properly. No deformed cases will be used. After cleaning case insert primer, then put in the proper powder charge and shake it down well, insert felt wad, pressing it down well on the powder charge; give the upper surface of the wad and the inside of case above the wad a heavy coat of rubberine paint. After this has dried, apply another coat of paint to thoroughly seal the clearance between the wad and the cartridge case.

In firing blank ammunition the gun should be sponged after each round.

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RATIONS.

485. DETAILS OF RATIONS CARRIED IN THE FIELD WITH UNITS.

How carried normally.	Field ration.	Reserve ration.
On each man	[1] 1½	2
On ration section of field train	2	1
In supply train:		
Infantry division	2	.....
Cavalry division	1	.....

[1] Unconsumed portion of field ration for noonday meal.

486. The field ration is prescribed in orders by the commander of the field forces. It consists of the reserve ration in whole or in part supplemented by available articles of food corresponding generally with the articles of the garrison ration.

487. The field allowance of fuel is one-twelfth cord per day for each mess fire. Same for each garbage pit fire.

488. Reserve rations consumed must be replaced at first opportunity. This includes the frequent renewal of the bacon component.

489. When rolling kitchens are used they carry one day's field ration, and the ration section of the field trains is reduced accordingly.

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(When ration savings privilege has been suspended.)

[In computing the carrying capacity of vehicles of field and supply trains, the weight of a ration, including containers, is taken at 3 pounds.]

A. Garrison ration.[1]				B. Field ration (suggested).				C. Reserve ration.
Components.		Substitutive equivalents.		Actual issues.				
Articles.	Quantities.	Articles.	Quantities.	No. 1.	No. 2.	No. 3.	No. 4.	
	Ounces.		*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*	*Ounces.*
Beef, fresh	20				14	14		
		Mutton, fresh	20					
		Bacon	12	12	3.6	3.6		12
		Canned meat	16					
		Fish, dried	14					
		Fish, pickled	18					
		Fish, canned	16					
		Chicken or turkey	16					
Flour	18							
		Hard bread	16	16				16
		Corn meal	20					
		Bread	18		16	16		
Baking powder	.08							
Beans	2.4			4	4	4		
		Rice	1.6					
		Hominy	1.6					
Potatoes	20				14	14		
		Onions	20			2		
		Tomatoes	20	10	5	2		
		Other fresh vegetables	20					

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Prunes	1.28			1.28	1.28	.384		
		Apples, evaporated	1.28			.128		
		Peaches, evaporated	1.28			.128		
		Jam	1.28			.64		
Coffee, roasted and ground.	1.12			1.12	1.12	1.12		1.12
		Coffee, green	1.4					
		Tea	.32					
Sugar	3.2			2.4	2.4	3.2		2.4
Milk, evaporated	.5							
Vinegar	[2].16					[2].08		
		Pickles	[2].16			[2].08		
Salt	.64			.16	.16	.64		.16
Pepper, black	.04				.02	.04		
Cinnamon	.014							
		Other spices	.14					
Lard	.64					.64		
		Lard substitute	.64					
Butter	.5							
		Oleomargarine	.5					
Sirup	[2].32							
Lemon extract	.014							
		Vanilla extract	.014					
Approximate net weight, pounds	4.4		4.5	2.935	[3]3.85	4.		1.98

[1] See Army Regulations for proportionate issues of substitutive equivalents required when issuing the straight garrison ration.

[2] Gill.

[3] Or, with beef supplied daily, 2.97 pounds.

NOTE.—The suggested field ration is adaptable as follows:
Nos. 1 and 2 for the use of troops in campaign.
No. 1 embraces all components of the ration.
No. 2 contemplates that fresh beef and fresh vegetables may be furnished the troops directly.
No. 3 provides more varied diet and is adaptable when troops are located near depots of supply.
No. 4 (column left blank for notation).

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FORAGE.

491. Grain is the only forage carried on field and supply trains.

	For each animal.		Substitute for oats.		
	Oats.	Hay.	Barley.	Corn.	Bran.[1]
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Horse	12	14	12	12	3
Mule	9	14	9	9	3

[1] In lieu of that quantity of grain. A. R.
Salt, 0.8 ounce; vinegar, 0.1 gill per day.

492. Forage is carried in the field—

On each vehicle, a reserve of one grain ration for each of its draft animals.

On horse, portion of unused grain ration for noonday feed.

On ration section of field train, two days' grain for each animal.

On supply train—

Infantry division, two days' grain.

Cavalry division, one day's grain.

OPERATION OF SUPPLY SERVICE.

(Par. 303 et seq., F. S. R.)

493. Rations and grain are ordinarily issued to troops in the afternoon from the ration section of the field train. This provides for the evening meal, the next morning's breakfast, and a lunch to be carried by the men. Similarly for the grain. When rolling kitchens are used the same method is followed.

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Empty vehicles of the ration section return to the distributing point at a specified hour, refill from the supply train and join ration section of the field train. When circumstances permit, the ration section of the field train may get supplies direct from the line of communications, the supply train then being a rolling reserve.

The empty portion of the supply train then goes to the refilling point for reloading from the line of communications. At the refilling point the supply trains are met and supplied from the supply columns. When distance permits the supply columns may go direct to the distributing points, the supply trains then being held in reserve. Or the supply trains may go direct to the railhead, omitting the use of the supply columns.

494. The location of the distributing points is communicated to the division daily in orders or by memorandum.

NOTES ON SUPPLIES.

CATTLE.

495. Oxen or steers should be between 2 and 5 years old and should yield 600 pounds of meat fit for issue.

Cows should be between 2 and 4 years old and should yield 400 pounds of meat fit for issue.

496. To estimate age of cattle by the teeth: Incisors (front of lower jaw) are complete at 3½ years. At 2 the two center ones are well up. After incisors are complete, estimate must be made by amount of wear. Gums recede with age.

497. To estimate weight:

(*a*) Pass animals over a set of scales and then take 50 to 60 per cent for meat.

(*b*) Use this formula—

$$\frac{\text{L (in feet)} \times 10 \times \text{G}^2 \text{ (in feet)}}{3} = \text{weight in pounds.}$$

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L=length from hollow on crop (fore part of shoulder blade) to root of tail.

G=girth close behind the shoulder.

Cattle in health should have: Eye bright, muzzle cool and moist, dung normal, coat glossy. Should stretch on rising and should chew the cud.

SHEEP.

498. Ram is male sheep; wether is castrated male sheep; ewe is female after she has lambed.

Sheep out of health have loose wool, dropping ears, arching back, legs drawn together under body, no fatty secretion under skin.

499. Sheep should yield 50 to 80 pounds meat fit for issue and should not be more than 5 years old. If it is possible to weigh a few, 50 to 60 per cent of the average live weight may be taken as the amount of meat to be expected.

500. To estimate age of sheep by the teeth: Teeth come up about 6 months earlier than in cattle.

HOGS.

501. Pigs should yield about 100 pounds meat fit for issue.

MEATS IN GENERAL.

502. Animals should be deprived of food for about 12 hours before slaughter.

Meat loses when hung 1¼ per cent in 24 hours (in temperate climate).

Meat loses when hung 2 per cent in 48 hours (in temperate climate).

Meat loses when hung 2½ per cent in 72 hours (in temperate climate).

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More would be lost in hot, dry climate.

Meat should, if possible, be hung 24 hours before being used.

BREAD.

(Manual for Army Bakers.)

503. Bread should be light, spongy, and elastic, properly seasoned and flavored.

Crust should be brownish yellow. A pale loaf results from an absence of sugar, a slow oven, or an old dough.

Good flour should be of a creamy, yellowish-white shade. The smell and taste should be that of freshly ground wheat.

One hundred pounds of wheat produces about 80 pounds of flour.

Wheat should weigh from 56 to 60 pounds per bushel.

One hundred pounds of flour will produce about 140 pounds of bread when 24 hours old.

FORAGE.

504. Good hay should be moderately fine, sweet smelling, well cured, and of a good fresh color; flowering heads should be present; no weeds.

The weight of hay in stacks varies from 112 to 300 pounds per cubic yard, depending upon class of hay, position in stack, age, etc. If possible, cut from stack sufficient quantity to obtain fair average and weigh. Otherwise, 200 pounds per cubic yard is fair average. Pressed hay weighs about 11 pounds per cubic foot (297 pounds per cubic yard).

To estimate weight of stack of hay:

$$\frac{\text{Height} \times \text{breadth} \times \text{length}}{11} = \text{tons of hay.}$$

Dimensions are in yards.

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For circular stacks:

$$\frac{3\ 1/7 \times \text{radius}^2 \times \text{length}}{11} = \text{tons of hay.}$$

Height=distance from ground to eaves+one-third distance from eaves to apex.

505. Oats should be clean, dry, plump, and full of flour, and have a metallic luster.

Good oats weigh about 40 pounds to the bushel; barley about 48 pounds; corn about 56 pounds. The last two are substitutes for oats. Bran is issued to supplement the oat ration as it prevents constipation; fed about twice a week, wet.

506. An old style tin cup holds seven-eighths pound good oats; the new style cup, three-fourths pound.

A cubic yard of oats equals 21.96 bushels.

HINTS ON THE SELECTION OF LOCALITIES AS REFILLING POINTS.

507. Wide open spaces having a hard level surface and solid foundations are ideal sites but rarely available. Transfer of loads must usually be made on the road.

In selecting locality the following points should be borne in mind:

Traffic along the line of supply columns should be permitted in only one direction, which should be toward the direction that the supply trains are to move after being refilled.

End-on loading, i. e., tailboard to tailboard, is the only practical method.

It will be usually necessary for the supply-column wagons or trucks to be reversed before being placed. They should be placed with sufficient space between wagons to allow the wagons

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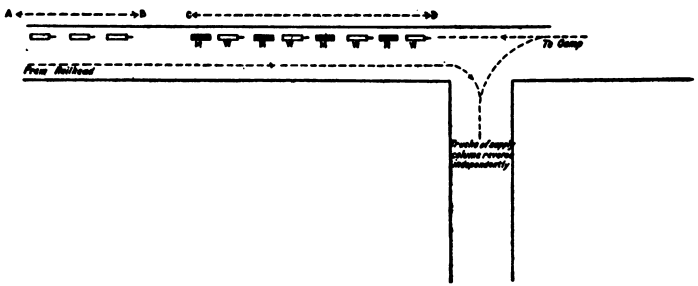
or trucks of the supply train to be moved to position tailboard to tailboard. Thus when loaded the supply-train vehicles move to the front in the desired direction of the flow of traffic.

The following diagram illustrates the above principles, but must be modified to meet conditions:



AB, park for trains.

CD, actual refilling point.

M, vehicles of supply columns in position.

W, vehicles of supply train in position.

If roads are not used, trains may be parked and a tailboard to tailboard transfer made.

REQUISITIONS.

(Pars. 290, 292, F. S. R.)

508. Amount to be left with the inhabitants is not fixed, but it is advisable to leave at least three days' supply for a household and somewhat more with outlying farms.

509. The following form may be used in receipting for requisitioned supplies. One copy goes to the person from whom the supplies are obtained; one to the officer designated to settle the account; one is retained by the officer securing the supplies.

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Q. M. C. FORM 254.
Authorized August 10, 1916.

Quartermaster Corps, U. S. Army.

Not negotiable.

RECEIPT FOR REQUISITIONED SUPPLIES IN AN ENEMY'S COUNTRY.

Received from_____

_____

P. O. address_____

Date_____

Quantity.	Article.	Condition.	Owner's estimate of value.	Estimated value.
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....

I certify that I have received the above stores; that I have not paid for same, and that they will be taken up and accounted for on my_____ for_____, 19

_____

_____

Place _____

_____

(Signature of person furnishing supplies.)

Authority _____

No. 58681

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INSTRUCTIONS TO HOLDER.

This receipt should be delivered to _____

_____
(Name of disbursing officer.)

at _____
(Address of disbursing officer.)

_____

within thirty days of its date.

The holder will request a certificate of acknowledgment at the time of turning in this receipt, which is intended to safeguard his interests in case of loss of this receipt during process of adjustment.

The holder is informed that this receipt will be examined and inquired into, and that he may be required to present satisfactory evidence as to ownership, value, etc., of the property taken before payment is made.

No payment can be made under any circumstances whatever until this receipt has been turned in.

(Under art. 52, Hague convention of Oct. 18, 1907. 36 Stat., 2308.)

WEIGHTS AND MEASURES.

510. The ordnance tin cup holds about seven-eighths of a quart and is most convenient in determining the weights of the several components of the ration used in camp and on the march. By filling it level full of the several articles noted below the weights there given were accurately determined.

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WEIGHT OF ONE ORDNANCE TIN CUP LEVEL FULL.

	Weight.	
	Lbs.	*Oz.*
Apples evaporated		8
Beans, chili	1	7
Beans, issue	1	8
Beans, kidney	1	5
Beans, lima	1	5
Bread crumbs		15
Coffee, R. & G		10
Coffee, Java, ground	1	
Coffee, Mocha, ground	1	2
Corn, sweet, dried	1	
Corn meal	1	4
Currants	1	8
Eggs, broken	1	13
Flour	1	
Hominy	1	4
Milk, fresh	1	12
Oatmeal		9
Peaches, evaporated	1	
Peaches, dried	1	8
Prunes	1	2
Raisins	1	
Rice	1	8
Salt, coarse	1	15
Salt, issue	2	
Sirup, cane	2	7
Sugar, cut loaf	1	
Sugar, granulated	1	8
Tea, English breakfast		6
Tea, Oolong		7
Tea, Young Hyson		10

One 3-gallon bucket of potatoes weighs 17 pounds; when peeled, these will make about 15 pounds.

One 3-gallon bucket of onions weighs about 14 pounds; when peeled, these will make about 11 pounds.

Six issue candles make 1 pound.

Ten lantern candles make 1 pound.

One bar of issue soap makes 1 pound.

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INDIVIDUAL COOKING.

511. For such individual cooking as may be necessary for the soldier when thrown upon his own resources, the following bills of fare have been prepared. Where the tin cup and spoon are mentioned, reference is made to those issued with the field mess kit.

Remember that the best fire for cooking is a small, clear one, or better yet, a few brisk coals.

Almost anything that can be cooked at all can be prepared in the mess kit, though the variety is necessarily small and quantities limited on account of few utensils of small capacity.

512. Company commanders in estimating the amounts that will be required for each meal may assume that one man will consume for one meal about—

1 ounce of sugar.

½ ounce of coffee, 1 ounce of chocolate or cocoa, or $\frac{1}{10}$ ounce of tea.

4 ounces of dried vegetables.

4 ounces of flour or 4 hardtacks.

8 ounces of fresh vegetables.

4 ounces of sliced bacon or 6 to 8 ounces of fresh meat.

$\frac{1}{3}$ ounce of salt.

$\frac{1}{50}$ ounce of pepper.

513. BILLS OF FARE.

No.	Meats.	Vegetables.	Bread, etc.	Drink.
1	Bacon	Boiled rice	Flapjack	Coffee.
2	Meat and vegetable stew.	do	do	Do.
3	Broiled steak	Fried potatoes and onions.	Hard bread	Cocoa.
4	Bacon	Stewed tomatoes	Hoecake	Coffee.
5	do	Oatmeal	Hard bread	Tea.
6	do	Baked potatoes; rice	Flapjack	Chocolate.
7	Fried steak	Boiled potatoes; cold tomatoes.	Hard bread	Coffee.
	Etc.	Etc.	Etc.	Etc.

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BILLS OF FARE—Continued.

OR, WHEN THE RATIONS IS MORE LIMITED.

No.	Meats.	Vegetables.	Bread, etc.	Drink.
8	Fried bacon	Fried potatoes	Hard bread	Coffee.
9	do		Flapjack	Do.
10	Corned beef (cold)	Tomato stew	Hard bread	Do.
11	Fried fish and bacon	Baked potatoes	do	Do.
12	Meat and vegetable stew.		Hoecake	Tea.
13	Broiled steak	Baked potatoes	Hard bread	Cocoa.
14	Boiled fish	Fried potatoes	do	Tea.
	Etc	Etc	Etc	Etc.

SUGGESTIONS FOR HANDLING BILL OF FARE NO. 1.

514. Take two-thirds of a cup of water and bring to a boil. Add 4 spoonfuls of rice and boil until soft; i. e., until it can be mashed by the fingers with but little resistance. This will require about 15 minutes. Add 2 pinches of salt and, after stirring, pour off the water and empty the rice out on the lid of the mess pan.

Meanwhile, fry 3 slices of bacon until slightly browned in the mess pan over a brisk fire or hot coals, and lay them on top of the rice, leaving sufficient grease in the pan in which to fry the flap jack.

Take 6 spoonfuls of flour and one-third spoonful of baking powder and mix thoroughly. Add sufficient cold water to make a batter that will drip freely from the spoon. Add a pinch of salt and 2 pinches of sugar and pour the batter into the mess pan, which should contain the grease from the fried bacon. Place over medium hot coals and bake from 5 to 7 minutes; see that it will slip easily in the pan and then by a quick toss turn it over and continue the baking from 5 to 7 minutes longer or until by examination it is found to be done.

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While the batter is frying wash out the tin cup; two-thirds fill with water and let come to a boil. Add 1 medium heaping spoonful of coffee and stir well, and, if desired, 1 spoonful of sugar and let boil for about 5 minutes. Let simmer for about 10 minutes longer. Settle by a dash of cold water or let stand a few minutes.

A hot meal is now ready to serve. Time, about 40 minutes.

RECIPES.

515. DRINKS.

(For one meal for one man.)

Article and amount.	Amount of water.	Add when—	Let boil.	Add sugar if desired.	Remarks.
	Cup.		*Min*	*Sp'nful.*	
Coffee, 1 heaping spoonful.	⅔	Water boils.	5	1	Stir grains well when adding. Let simmer 10 minutes after boiling. Settle with a dash of water or let stand a few minutes. Ready to serve.
Cocoa, 1 heaping spoonful.	⅔	...do....	5	1½	Stir when adding until dissolved. Ready to serve when sufficiently cooled.
Chocolate, 1 cubic inch.	⅔	...do....	5	1½	Do.
Tea, ½ level spoonful.	⅔	...do....	0	1	Let stand or "draw" 8 minutes. If allowed to stand longer, the tea will get bitter unless separated from the grains.

NOTE.—Coffee made by above recipe is of medium strength and the same as when using 4 ounces to the gallon of water. It is within the limit of the ration if made but twice each day.

Tea.—A little more than medium strength, the same as when using three-fifths ounce to the gallon, and within the ration allowance if made three times per day.

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Chocolate and cocoa.—About 1 ounce per man per meal. If available, milk should be used in the place of water and should be kept somewhat below the boiling point. Mix a 1-pound can of evaporated milk with 8½ quarts of water to make 1 gallon of milk of the proper consistency for use in making cocoa or chocolate.

516. DRIED VEGETABLES.

(For one meal for one man.)

Article and amount.	Amount of water.	Add when—	Let boil.	Season with pinches of salt.	Add heaping spoonful sugar if desired.	Remarks.
	Cup.		*Hrs.*			
Rice, 4 heaping spoonfuls.	⅔	Water boils.	½	2	1	Should be boiled until grains (while still nicely separated) may be crushed between the fingers with but little resistance. Then drain off the water.
Cornmeal, hominy, fine oatmeal, 4 heaping spoonfuls.	⅓	...do.....	½	2	....	All water should now be taken up by the cornmeal, hominy, or oatmeal, which forms a thick paste.
Dried sweet corn, 4 heaping spoonfuls.	⅓	...do.....	½	2	1	
Lima beans, 4 heaping spoonfuls.	⅔	Water is put on.	2–3	1	....	When done the beans should still be whole but soft. Add one small slice of bacon one-half hour before done. Add water as required.
Chili beans and frijoles, 4 heaping spoonfuls.	⅔	...do.....	3–4	1	....	Above remark applies.
Beans, issue, dried green peas, hominy, coarse split peas, 4 heaping spoonfuls.	⅔	...do.....	3–4	1	....	Not recommended on account of time required for cooking.

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NOTE.—By a heaping spoonful is meant here all that can readily be taken up. A pinch of salt is the amount that can readily be taken up between the end of the thumb and forefinger.

MEATS.

517. *Bacon.*—Cut side of bacon in half lengthwise. Then cut slices about five to the inch, three of which should generally be sufficient for one man for one meal. Place in a mess pan with about one-half inch of cold water. Let come to a boil and then pour the water off. Fry over a brisk fire, turning the bacon once and quickly browning it. Remove the bacon to lid of mess pan, leaving the grease for frying potatoes, onions, rice, flapjacks, etc., according to recipe.

Fresh meat.—To fry: A small amount of grease (one to two spoonfuls) is necessary. Put grease in mess pan and let come to a smoking temperature, then drop in the steak and, if about one-half inch thick, let fry for about one minute before turning—depending upon whether it is desired it shall be rare, medium, or well done. Then turn and fry briskly as before. Salt and pepper to taste.

Applies to beef, veal, pork, mutton, venison, etc.

Fresh meat.—To broil: Cut in slices about 1 inch thick, from half as large as the hand to four times that size. Sharpen a stick or branch of convenient length, say, from 2 to 4 feet long, and weave the point of the stick through the steak several times so that it may be readily turned over a few brisk coals or on the windward side of a small fire. Allow to brown nicely, turning frequently. Salt and pepper to taste. Meat with considerable fat is preferred, though any meat may be broiled in this manner.

Fresh meat.—To stew: Cut into chunks from one-half inch to 1-inch cubes. Fill cup about one-third full of meat and cover with about 1 inch of water. Let boil or simmer about one hour

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or until tender. Add such fibrous vegetables as carrots, turnips, or cabbage, cut into small chunks, soon after the meat is put on to boil, and potatoes, onions, or other tender vegetables when the meat is about half done. Amount of vegetables to be added, about the same as meat, depending upon supply and taste. Salt and pepper to taste. Applies to all fresh meats and fowls. The proportion of meat and vegetables used varies with their abundance, and fixed quantities can not be adhered to. Fresh fish can be handled as above, except that it is cooked much quicker, and potatoes, onions, and canned corn are the only vegetables generally used with it, thus making a chowder. A slice of bacon would greatly improve the flavor. May be conveniently cooked in mess pan or tin cup.

FRESH VEGETABLES.

518. *Potatoes, fried.*—Take two medium-sized potatoes or one large one (about one-half pound), peel and cut into slices about one-fourth inch thick and scatter well in the mess pan in which the grease remains after frying the bacon. Add sufficient water to half cover the potatoes, cover with the lid to keep the moisture in, and let come to a boil from 15 to 20 minutes. Remove the cover and dry as desired. Salt and pepper to taste. During the cooking the bacon already prepared may be kept on the cover, which is most conveniently placed bottom side up over the cooking vegetables.

Onions, fried.—Same as potatoes.

Potatoes, boiled.—Peel two medium-sized potatoes or one large one (about one-half pound), and cut in coarse chunks of about the same size—say, 1½-inch cubes. Place in mess pan and three-fourths fill with water. Cover with lid and let boil or simmer for 15 or 20 minutes. They are done when easily penetrated with a sharp stick. Pour off the water and let dry out for one or two minutes over hot ashes or light coals.

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Potatoes, baked.—Take two medium-sized potatoes or one large one cut in half (about one-half pound). Lay in a bed of light coals, cover with same, and smother with ashes. Do not disturb for 30 or 40 minutes, when they should be done.

Canned tomatoes.—One 2-pound can is generally sufficient for five men.

Stew.—Pour into the mess pan one man's allowance of tomatoes, add about two large hardtacks broken into small pieces, and let come to a boil. Add salt and pepper to taste, or add a pinch of salt and one-fourth spoonful of sugar.

Or, having fried the bacon, pour the tomatoes into the mess pan, the grease remaining, and add, if desired, two broken hardtacks. Set over a brisk fire and let come to a boil.

Or, heat the tomatoes just as they come from the can, adding two pinches of salt and one-half spoonful of sugar if desired.

Or, especially in hot weather, eaten cold with hard bread they are very palatable.

HOT BREADS.

519. *Flapjack.*—Take 6 spoonfuls of flour and one-third spoonful of baking powder and mix thoroughly (or dry mix in a large pan before issue, at the rate of 25 pounds of flour and three half-pound cans of baking powder for 100 men). Add sufficient cold water to make a batter that will drip freely from the spoon, adding a pinch of salt. Pour into the mess pan, which should contain the grease from fried bacon, or a spoonful of butter or fat, and place over medium-hot coals sufficient to bake so that in from five to seven minutes the flapjack may be turned by a quick toss of the pan. Fry from five to seven minutes longer or until, by examination, it is found to be done.

Hoecake.—Hoecake is made exactly the same as a flapjack by substituting corn meal for flour.

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CHAPTER VII.

PAY.

520. TABLE OF MONTHLY PAY OF ENLISTED MEN SERVING IN ENLISTMENT PERIODS AS INDICATED:

Private; private, second class; and bugler:	
First	$30
Second	33
Third	36
Fourth	37
Fifth	38
Sixth	39
Seventh	40
Private, first class:	
First	33
Second	36
Third	39
Fourth	42
Fifth	45
Sixth	48
Seventh	51
Corporal (Artillery, Cavalry, Infantry), saddler, mechanic (Infantry, Cavalry, Field Artillery, Medical Department), farrier, and wagoner:	
First	36
Second	39
Third	42
Fourth	45
Fifth	48
Sixth	51
Seventh	54
Corporal (Engineers, Ordnance, Signal Corps, Quartermaster Corps, Medical Department); mechanic, Coast Artillery; chief mechanic, Field Artillery; and musician, third class (Infantry, Cavalry, Artillery, Engineers):	
First	$36
Second	39
Third	42
Fourth	45
Fifth	48
Sixth	51
Seventh	54
Sergeant (Artillery, Cavalry, Infantry); stable sergeant (Field Artillery, Cavalry, Infantry); supply sergeant (Artillery, Cavalry, Infantry); mess sergeant (Artillery, Cavalry, Infantry); cook; horseshoer; radio sergeant; fireman; band corporal; musician, second class (Artillery, Cavalry, Infantry, Engineers); mu-	

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Sergeant—Continued.	
sician, third class, Military Academy:	
First	$38
Second	41
Third	44
Fourth	47
Fifth	50
Sixth	53
Seventh	56
Sergeant (Engineers, Ordnance, Signal Corps, Quartermaster Corps, Medical Department); stable sergeant, Engineers; supply sergeant, Engineers; mess sergeant, Engineers; color sergeant; electrician sergeant, second class; band sergeant; musician, first class (Infantry, Cavalry, Artillery, Engineers); musician, second class, Military Academy:	
First	44
Second	48
Third	52
Fourth	56
Fifth	60
Sixth	64
Seventh	68
Battalion sergeant major (Field Artillery, Infantry); squadron sergeant major; sergeant major, junior grade; master gunner; sergeant bugler; assistant band leader:	
First	48
Second	52
Third	$56
Fourth	60
Fifth	64
Sixth	68
Seventh	72
Regimental sergeant major; regimental supply sergeant; sergeant major, senior grade; quartermaster sergeant, Quartermaster Corps; ordnance sergeant; first sergeant; battalion sergeant major, Engineers; battalion supply sergeant, Engineers; electrician sergeant, first class; sergeant, first class (Quartermaster Corps, Engineers, Signal Corps); assistant engineer; musician, first class, Military Academy:	
First	51
Second	55
Third	59
Fourth	63
Fifth	67
Sixth	71
Seventh	75
Sergeant, first class, Medical Department; sergeant, field musician, Military Academy:	
First	56
Second	60
Third	64
Fourth	68
Fifth	72
Sixth	76
Seventh	80

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Hospital sergeant; master engineer, junior grade; engineer:	
First	$71
Second	75
Third	79
Fourth	83
Fifth	87
Sixth	91
Seventh	95
Quartermaster sergeant, senior grade, Quartermaster Corps; band leader; master signal electrician; master electrician; master engineer, senior grade; master hospital sergeant; band sergeant and assistant leader, Military Academy:	
First	$81
Second	85
Third	89
Fourth	93
Fifth	97
Sixth	101
Seventh	105

521. NOTES.—(*a*) Privates, Medical Department, who had the grade of private, Hospital Corps, on June 2, 1916, are entitled to initial pay of $16 per month during the remainder of their current enlistment (Dec. Comp., June 9, 1916). Men enlisting in the grade of private, Medical Department, or men transferred to that grade on or after June 3, 1916, are entitled to initial pay of $15.

(*b*) Each aviation enlisted man, while on duty that requires him to participate regularly and frequently in aerial flights, or while holding the rating of aviation mechanician, shall receive an increase of 50 per cent in his pay.

(*c*) The base or initial pay of mess sergeants, Corps of Engineers, is $36 per month, and no more. The base or initial pay of mess sergeants of Infantry, Cavalry, and Artillery is $30 per month, and no more. Men properly detailed as mess sergeants in the arms of the service for which the grade of mess sergeant is not provided are entitled to the pay of the grades actually held by them, plus $6 per month, as provided in the act of May 11, 1908.

(*d*) Packmaster (sergeant, first class), assistant packmaster (sergeant), and cargador (corporal) of battery of mountain artillery or mountain artillery headquarters company, when no

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enlisted men of the Quartermaster Corps are attached for such positions, are entitled to initial pay at rate of $45, $36, and $24 monthly, respectively.

(*e*) "Commencing June one, nineteen hundred and seventeen, and continuing until the termination of the emergency, all enlisted men of the Army of the United States in active service whose base pay does not exceed $21 per month shall receive an increase of $15 per month; those whose base pay is $24, an increase of $12 per month; those whose base pay is $30, $36, or $40, an increase of $8 per month; and those whose base pay is $45 or more, an increase of $6 per month; *Provided*, That the increases of pay herein authorized shall not enter into the computation of continuous-service pay." (Act approved May 18, 1917.)

Increase of twenty per centum for foreign service under act of June 30, 1902, not payable on increases of pay authorized under the act of May 18, 1917. (Dec. Comp., May 29, 1917.)

522. Additional pay per month: Mess sergeant, $6; casemate electrician, $9; observer, first class, $9; plotter, $9; coxswain, $9; chief planter, $7; chief loader, $7; observer, second class, $7; gun commander, $7; gun pointer, $7; surgical assistant, $5; expert first-class gunner, Field Artillery, $5; expert rifleman, $5; nurse (first-class private), $3; sharpshooter, $3; first-class gunner, $3; second-class gunner, $2; marksman, $2; dispensary assistant, $2; certificate of merit, $2.

CLOTHING AND EQUIPMENT.

523. Field service is defined to be service in moblization, concentration, instruction, or maneuver camps, as well as service in campaign, in simulated campaign, or on the march.

524. The complete equipment for field service (equipment "C") consists of engineer, ordnance, signal, medical, and quartermaster property, and is divided into two classes, "A" and "B."

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Equipment "A" is the equipment prescribed for use in campaign, in simulated campaign, or on the march. It is limited to the animals and vehicles prescribed in the Tables of Organization, the equipment and clothing worn on the person, and the articles carried on mount, and transported in field, combat, and divisional trains.

Equipment "B" is the equipment which, in addition to equipment "A," is prescribed for the use of troops in mobilization, concentration, instruction, or maneuver camps, and during such pauses in operations against an enemy as permit the better care of troops.

Equipment "C" is the sum of equipments "A" and "B," and therefore includes every article prescribed for field service as hereinbefore defined.

When troops are ordered on field service, instructions will state the letter designation of the equipment to be taken. The instructions will also specify whether mosquito bars and headnets are to form a part of the equipment, and what winter articles, if any, are to be included. The same rule will apply in the issuance of subsequent orders when necessary. Articles distinctively for winter use can be transported as baggage on the march only when transportation in addition to that prescribed in equipment "A" is provided for that purpose. In addition to the allowances prescribed as the field equipments, service coats, cravats, fatigue clothing, and other articles of uniform, extra bedding, and toilet articles may be taken by officers and enlisted men with equipment "B" when authorized in orders directing the movement of troops.

The articles of engineer, ordnance, and signal property listed in the several Unit Accountability Equipment Manuals belong to equipment "A." The articles of medical property belonging to equipment "A" are shown in the Manual for the Medical Department. The articles of quartermaster property belonging

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to equipments "A," "B," and "C," respectively, are shown in G. O. No. 39, W. D., 1915.

TABLES OF FUNDAMENTAL ALLOWANCES.

525. These tables give the individual equipments and such unit allowances as vary with the strength of an organization. There are certain articles, such for example, as colors, guidons, standards, distinguishing flags, branding irons, marking pots, tool sets, etc., of which the allowances for any organization remain constant for all strengths.

The designation "company," as used herein, applies to troops, batteries, and companies (except bakery companies) mentioned in the Tables of Organization, and to bands not forming part of a company.

526. INDIVIDUAL EQUIPMENT.

Articles.	Enlisted man.			Officer.			Remarks.
	A.	B.	C.	A.	B.	C.	
Bag, barrack	....	....	....	[1] 1	....	[1] 1	[1] Optional.
Bar, mosquito, single.	(1)	(1)	1	1	....	1	[1] 1 for every 2 men only.
Basin, canvas	....	....	....	1	....	1	
Baton	[1] 1	....	[1] 1	....	....	....	[1] For drum major of dismounted band only.
Bedding roll	....	....	....	[1] 1	....	[1] 1	[1] Or a canvas roll as a combination bedding-clothing roll.
Bed sack	....	1	1	[1] 1	....	[1] 1	[1] Optional.
Blankets, olive drab	1	1	2	1	1	2	
Brassards:							
Red	[1] 1	....	[1] 1	....	....	....	[1] For each mounted orderly of Infantry and Cavalry regiments. each mounted man assigned as orderly to brigade and higher commanders, and each agent of communication of Field Artillery and machine-gun companies only.
Blue	[1] 1	....	[1] 1	....	....	....	[1] For each member of the military police only.

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INDIVIDUAL EQUIPMENT—Continued.

Articles.	Enlisted man.			Officer.			Remarks.
	A.	B.	C.	A.	B.	C.	
Bucket, canvas	....	....	....	1	....	1	
Bugle, with sling	[1] 1	....	[1] 1	....	....	....	[1] For each bugler and each field musician only.
Clothing (the men's clothing herein listed includes that worn on person, but the officers' does not):							
Belt, waist	1	....	1	1	....	1	
Breeches, pair	[1] 1	[1] 1	[1] 2	[1] 1	[1] 1	[1] 2	[1] See notes 2 and 3, page 50, Uniform Regulations.
Chevrons, and other sleeve insignia, service.	(1)	....	(1)	....	....	....	[1] As per paragraph 84 (j), Uniform Regulations; chevrons, 1 pair for olive drab shirt, 1 pair for sweater, and 1 pair for overcoat only; other sleeve insignia (par. 84 (h), Uniform Regulations), pair for overcoat only.
Cord, hat	1	....	1	....	....	....	
Drawers, pair	[1] 2	[1] 1	[1] 3	[1] 3	[1] 1	[1] 4	[1] See paragraph 50, Uniform Regulations.
Gloves—							
Horsehide, yellow, pair.	[1] 1	....	[1] 1	....	....	....	[1] For each member of machine-gun companies only.
Riding, pair	[1] 1	....	[1] 1	....	....	....	[1] For each mounted man only.
Woolen, pair	[1] 1	....	[1] 1	[1] 1	....	[1] 1	[1] Winter use; for dismounted duty only.
Hat, service, with tying cord.	1	....	1	....	....	....	
Laces, shoe, extra, pair.	1	1	2	1	1	2	
Leggins—							
Canvas, pair	[1] 1	....	[1] 1	....	....	....	[1] With leather reinforced for mounted men.
Shirts, flannel, olive drab.	1	1	2	1	1	2	
Shoes, marching, pair.	1	1	2	1	1	2	
Stockings, pair	[1] 2	[1] 2	[1] 4	[1] 5	[1] 1	[1] 6	[1] See paragraph 50, Uniform Regulations.

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INDIVIDUAL EQUIPMENT—Continued.

Articles.	Enlisted man.			Officer.			Remarks.
	A.	B.	C.	A.	B.	C.	
Clothing—Continued.							
Tag, identification.	1	....	1	1	....	1	
Tape, for identification tags, yards.	1	....	1	1	....	1	
Undershirts	[1] 2	[1] 1	[1] 3	[1] 3	[1] 1	[1] 4	[1] See paragraph 50, Uniform Regulations.
Clothing roll	....	....	....	[1] 1	....	[1] 1	[1] Or a canvas roll as a combination bedding-clothing roll.
Cot	....	1	1	....	1	1	
Head net, mosquito	[1] 1	....	[1] 1	[1] 1	....	[1] 1	[1] Only when specially ordered.
Instrument, band	[1] 1	....	[1] 1	....	....	....	[1] For each bandsman only. See A. R. 262 and 1179.
Lantern, combination	....	....	....	[1] 1	....	[1] 1	[1] Or a folding lantern.
Locker, trunk	....	....	....	....	1	1	
Nails, horseshoe, number.	[1] 16	....	[1] 16	[1] 16	....	[1] 16	[1] For each mounted officer and each mounted man only; carried on mount.
Overcoat	[1] 1	....	[1] 1	....	....	....	[1] Winter use.
Pins, tent, shelter	[1] 5	....	[1] 5	[2] 10	....	[2] 10	[1] 5 for each civilian employee also. [2] For officer below the rank of major only.
Poles, tent, shelter	[1] 1	....	[1] 1	[1] 2	....	[1] 2	[1] 1 for each enlisted man of all arms, except Infantry, Engineers, and Coast Artillery; 1 for each man of Infantry, Engineers, and Coast Artillery who is not armed with a rifle; 2 for each officer below the rank of major; 1 for each civilian employee.
Poncho	[1] 1	....	[1] 1	[1] 1	....	[1] 1	[1] For each dismounted officer; for each dismounted man, except wagon drivers of field trains and enlisted men of the Quartermaster Corps only.
Pouch, music, olive drab.	[1] 1	....	[1] 1	....	....	....	[1] For each bandsman only.
Ration	(1)	....	....	....	....	....	[1] As prescribed in paragraph 302 Field Service Regulations.

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INDIVIDUAL EQUIPMENT—Continued.

Articles.	Enlisted man.			Officer.			Remarks.
	A.	B.	C.	A.	B.	C.	
Shoes, horse and mule, fitted, number.	[1] 2	....	[1] 2	[1] 2	....	[1] 2	[1] For each mounted officer and each mounted man only; carried on mount.
Slicker	[1] 1	....	[1] 1	[1] 1	....	[1] 1	[1] For each mounted officer, for each mounted man, and for each enlisted man of the Quartermaster Corps only.
Sling, color, olive drab.	[1] 1	....	[1] 1	....	....	....	[1] For each color sergeant (or acting color sergeant) only.
Stand, music	....	[1] 1	[1] 1	....	....	....	[1] For each bandsman only.
Tents, shelter, half:							
Dismounted	[1] 1	....	[1] 1	....	....	....	[1] For each enlisted man of Infantry, Engineers, and Coast Artillery, including attached enlisted men of the Quartermaster and Hospital Corps.
Mounted	[1] 1	....	[1] 1	[1] 2	....	[1] 2	[1] 1 for each enlisted man except Infantry, Engineers, and Coast Artillery, including attached enlisted men of the Quartermaster and Hospital Corps; 2 for each officer below the rank of major; 1 for each civilian employee.
Toilet articles:							
Comb	[1] 1	....	[1] 1	1	....	1	[1] A. R. 1217.
Housewife	[1] 1	....	[1] 1	....	....	....	[1] 1 per squad; carried as baggage.
Mirror	....	....	....	1	....	1	
Paper, toilet, package.	....	(1)	(1)	1	....	1	[1] As needed from company supply, A. R. 1215.
Soap, cake	[1] 1	(1)	(1)	1	....	1	[1] A. R. 1215.
Toothbrush	[1] 1	....	[1] 1	1	....	1	[1] A. R. 1217.
Towels, face	[1] 1	....	[1] 1	3	....	3	[1] A. R. 1217.
Whistle and chain	[1] 1	....	[1] 1	[1] 1	....	[1] 1	[1] For each company, battalion, and regimental officer except chaplains and medical officers; for each sergeant (except band sergeants) of Cavalry, Engineers, and signal troops; each scout and noncommissioned staff officer of Field Artillery; each

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INDIVIDUAL EQUIPMENT—Continued.

Articles.	Enlisted man.			Officer.			Remarks.
	A.	B.	C.	A.	B.	C.	
							musician of Engineer and Infantry companies; each sergeant of all Infantry companies, except headquarters and supply companies; and each wagon master and pack master.
MARCH EQUIPMENT CARRIED BY INDIVIDUALS, BUT NOT ISSUED TO THEM.							
Colors, guidons, and standards.	(1)	....	(1)	....	....	....	1 As prescribed in A. R. 232-238.
Farrier's instrument pocket case.	1 1	....	1 1	....	....	....	1 Carried by stable sergeant.
Horseshoer's emergency equipment.	(1)	....	(1)	....	....	....	1 Carried by horseshoers; Infantry regiments have two such equipments, 1 for shoeing animals with the column on the march and 1 for shoeing animals with the field train.
Mender, harness.....	(1)	....	(1)	....	....	....	1 Carried by saddler (or acting saddler). 1 harness mender for each battalion combat train of Infantry and Cavalry only.
Veterinarian's saddlebag.	....	....	....	(1)	....	(1)	1 Carried by veterinarian.

The tables include the necessary supplies for the care of officers' mounts as prescribed in A. R. 1096; the tentage, fuel, and mineral oil required by officers form a part of the equipment of the organization with which they serve; the other articles of their quartermaster field equipment are sold, but not issued, to them. Only such articles of quartermaster clothing

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are listed as officers' equipment as the specifications for their uniform permit. For the complete list of articles officers are required to have in their possession, see "Uniform Regulations."

The articles of individual equipment "A" for enlisted men, with the exception of those for winter use only, are carried by the men or on their mounts. The articles for winter use are carried by the men or in field train.

527. COMPANY EQUIPMENT.

[Amount depending upon the enlisted strength of a company.]

Articles.	A.	B.	C.	Remarks.
Axes and helves	[1] 2	....	....	[1] 1 only for pack-train company.
	...	(1)	....	[1] 1 per 20 men or major fraction thereof. For Infantry and Cavalry.
	....	....	[1] 2	[1] Add 1 for every 20 men or major fraction thereof.
Bag, surplus kit	....	(1)	(1)	[1] 1 per squad, 1 for sergeants, and 1 for cooks and buglers of companies; and 1 for every 8 men of detachments.
Broom, corn	....	(1)	(1)	[1] 1 for 20 men or major fraction thereof.
Brush, scrubbing	....	(1)	(1)	[1] 1 per 30 men or major fraction thereof.
Buckets, galvanized iron	[1] 2	....	....	[1] Add 1 for every 50 men, or major fraction thereof, in excess of 100. None furnished Mountain Artillery.
	...	(1)	....	[1] 1 per 50 men or major fraction thereof.
	....	....	(1)	[1] For Mountain Artillery, 1 per 50 men or major fraction thereof. For companies of other arms, 1 for every 25 men, except that the minimum allowance for any company is 3.
Can, drinking water	....	(1)	(1)	[1] 1 per 50 men or major fraction thereof.
Cooking utensils, march kit: Kettles, camp	[1] 2	....	[1] 2	[1] Add 1 for every 25 men, or major fraction thereof, in excess of 50.

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COMPANY EQUIPMENT—Continued.

Articles.	A.	B.	C.	Remarks.
Cooking utensils, march kit—Con.				
Pans—				
Bake	[1] 2	....	[1] 2	[1] Add 1 for every 25 men, or major fraction thereof, in excess of 50.
Dish	[1] 1	....	[1] 1	[1] Add 1 for every 50 men, or major fraction thereof, in excess of 50.
(Remaining utensils of the march kit are fixed at 1 each per company.)				
Pickaxes and helves	[1] 2	....	....	[1] 1 only for pack-train company. For Infantry and Cavalry.
	....	(1)	....	[1] 1 per 20 men or major fraction thereof. For Infantry and Cavalry.
	....	....	[1] 2	[1] Add 1 for every 20 men or major fraction thereof.
Rake, steel	....	(1)	(1)	[1] 1 per 50 men or major fraction thereof.
Ranges, field, complete:				
No. 1	....	(1)	(1)	[1] 1 for each company having a prescribed strength in excess of 50.
No. 2	....	(1)	(1)	[1] 1 for each company having a prescribed strength not in excess of 50.
Shovels, short-handled	(1)	(1)	(1)	1 For Infantry and Cavalry only.
	[1] 2	....	....	Not supplied to Infantry and Cavalry. [1] 1 only for pack train company.
Spades	....	(1)	....	[1] 1 per 20 men or major fraction thereof. Not supplied to Infantry and Cavalry.
	....	....	[1] 2	[1] Add 1 for every 20 men or major fraction thereof.
Stoves, tent	(1)	(1)	(1)	[1] Winter use; 1 per hospital, 1 per pyramidal, 1 per storage, 1 per wall, and 4 per ward tent.
Stovepipe elbows	(1)	(1)	(1)	[1] Winter use; 2 per hospital, 2 per storage, and 2 per wall tent.
Stovepipe, joints	(1)	(1)	(1)	[1] Winter use; 6 per hospital, 5 per large pyramidal, 4 per small pyramidal, 7 per storage, 7 per wall, and 28 per ward tent.

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COMPANY EQUIPMENT—Continued.

Articles.	A.	B.	C.	Remarks.
Tentage, heavy: (See also "Allowance of heavy tentage," page 554, G. O. 39, W. D. 1915.)				
Pyramidal, large, complete	....	(1)	(1)	[1] 1 for office, 1 for storage of supplies, 1 for every 8 men as quarters.
ADDITIONAL CAMP SUPPLIES.				
(Provided by camp quartermaster. See also under "Miscellaneous supplies," page 552, G. O. 39, W. D. 1915.)				
Cans—				
Garbage	....	(1)	(1)	[1] 1 per 50 men or major fraction thereof.
Night urinal	....	(1)	(1)	[1] 1 per 100 men or major fraction thereof. For companies of 100 men or less, 1 can.

UNIFORM AND EQUIPMENT FOR FIELD SERVICE.

528. For all officers, acting dental surgeons, and veterinarians:

WHEN DISMOUNTED.
"A."

1. Service hat, with hat cord sewed on (peaked, 4 indentations).
2. Olive-drab shirt.
3. Service coat.
4. Service breeches.
5. Russet-leather shoes (high).
6. Russet leather, pigskin, or canvas leggings, or woolen puttees.
7. Ribbons, by those entitled thereto (if coat is worn).

WHEN DISMOUNTED—continued.
"A"—Continued.

8. Olive-drab woolen gloves, when prescribed (optional, when not on duty).
9. Identification tag.
10. Haversack (containing meat can, knife, fork, and spoon).
11. Canteen (with canteen cover).
12. Cup.
13. First-aid packet (with pouch).
14. Watch.
15. Notebook and pencils.

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WHEN MOUNTED.

"B."

Same as for dismounted officers, omitting "8. Olive-drab woolen gloves," etc., and "10. Haversack (containing meat can, etc.)." and adding:

1. Regulation riding gloves.
2. Spurs.
3. Saddle.
4. Halter (with old model equip.).
5. Bridle.
6. Saddle blanket.

WHEN MOUNTED—continued.

"B."—Continued.

7. Saddlecloth.
8. Saddlebags or pommel pockets (containing meat can, knife, fork, and spoon).
9. Surcingle or cooling strap.
10. Nosebag or feed bag.
11. Horse brush.
12. Currycomb.
13. Lariat.
14. Picket pin.
15. Ration bags (new model equip.).

For officers entitled to horse equipment, see par. 1520, A. R., 1917.

529. For all officers, except officers of the Medical Department and chaplains:

WHEN DISMOUNTED.

Add to "A":

1. Pistol (with holster and 21 rounds of ammunition).
2. Pistol belt (to be worn over the coat).
3. Field glass.
4. Compass.

NOTE.—Company officers and battation commanders of Infantry will carry whistles. Dispatch cases for staff officers.

WHEN MOUNTED.

Add to "B":

1. Pistol (with holster and 21 rounds of ammunition).
2. Pistol belt (to be worn over the coat).
3. Field glass.
4. Compass.
5. Saber.

NOTE.—Medical officers on duty with the sanitary units of the mobile army will carry field glasses and compass.

Under par. 1522, A. R., 1917, items 1 and 2 may be drawn from the organization with which the officer is serving.

The field glasses issued to organizations by the Signal Corps are not issued for the personal use of officers, and will

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not be used in lieu of the officers' personal field glasses. This does not prohibit the use of high-power glasses by battery and machine-gun company commanders.

530. NOTES.—(1) Whenever necessary for personal protection, the personnel of the Medical Department may carry pistols.

(2) Veterinarians when in the field will carry pistols and ammunition.

(3) General officers, officers of the staff corps and departments, and Cavalry officers will wear the officers' leather waist belt with magazine pocket and necessary leather slides—for first-aid packet pouch, for the canteen, and for the pistol holster. Officers of Infantry, Field Artillery, Engineers, Coast Artillery, and Signal Corps will wear the web pistol belt, model of 1912.

531. For enlisted men:

WHEN DISMOUNTED.	WHEN MOUNTED.
1. Service hat, with hat cord sewed on (peaked, 4 indentations).	Same as dismounted, omitting "10. Olive-drab woolen gloves," and adding:
2. Olive-drab shirt.	1. Regulation riding gloves, when prescribed.
3. Service coat.	2. Spurs.
4. Service breeches.	
5. Russet leather shoes.	
6. Leggings.	
7. Identification tag.	
8. Brassards, by those entitled to wear them.	
9. Ribbons by those entitled thereto. (Ribbons will not be worn on the olive-drab shirt.)	
10. Olive-drab woolen gloves, when prescribed (optional when not on duty).	
11. Field belt.	

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532. The personal equipment of enlisted men will be as prescribed in orders and regulations.

533. NOTES.—(1) There are two kinds of service uniform, the woolen olive-drab and the cotton olive-drab. The woolen olive-drab uniform will be prescribed for habitual wear when the climate or weather does not require the cotton olive-drab.

(2) When under arms, every enlisted man will carry the arms pertaining to his grade and branch of service.

(3) With dismounted service uniform, in the field, noncommissioned staff officers will carry the pistol instead of the saber.

(4) When troops are traveling by rail, the train commander may cause the arms and equipments not required for the necessary guard duty en route to be properly secured and stored in a property or baggage car. (Par. 393, F. S. R., 1914.)

CLOTHING COMPONENT OF THE FIELD KIT AND THE SURPLUS KIT.

534. The field kit, clothing component, for all arms and branches of the service, mounted and dismounted, in addition to the clothing worn on the person, is composed of the following articles: One blanket; 1 comb; 1 drawers, pair; 1 poncho (dismounted men); 1 slicker (mounted men; for all enlisted men of the Quartermaster Corps, both mounted and dismounted; also for enlisted men of the Hospital Corps detailed as ambulance drivers and ambulance orderlies); 1 soap, cake; 2 stockings, pairs; 1 toothbrush; 1 towel; 1 undershirt; 1 housewife (for 1 man of each squad). The foregoing field kit, which is carried on the person by dismounted men and on the saddle by mounted men, is supplemented by the surplus kit, the two together making up the clothing component of the service kit.

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535. The surplus kit consists of 1 breeches, pair; 1 drawers, pair; 1 shirt, olive drab; 1 shoes, russet leather, pair; 2 stockings, pairs; 1 shoe laces, extra pair; 1 undershirt. The surplus kit pertains to equipment "B" as part of the permanent camp equipment, to be forwarded to troops when serving in instruction, maneuver, mobilization, or concentration camps, or when in active service a temporary suspension of operations permits the troops to refit. In peace-time maneuvers and marches the surplus kit may accompany the troops if so directed in the orders prescribing the movement. The vehicles and animals of the combat train and those representing the divisional supply train will be utilized to transport them.

536. Surplus kit bags will be issued to each organization at the rate of one to each squad, one for the sergeants, and one for the cooks and buglers, and one for every eight men of detachments.

Each bag will be marked with the letter of the company and the number of the regiment, as provided in paragraph 295, Army Regulations, for haversacks, and the proper designation of the squads to which the bags belong, both markings to be in the center of front cover flap.

537. The kit bag for the sergeants and that for the cooks and buglers will be marked "Sergeants," "Cooks and buglers," respectively. Similarly the kit bags for detachments will be appropriately marked.

538. The kit of each man will be packed as follows: Stockings to be rolled tightly, one pair in the toe of each shoe; shoes placed together, heels at opposite ends, soles outward, wrapped tightly in underwear, and bundle securely tied around the middle by the extra pair of shoe laces, each bundle to be tagged with the company number of the owner. These individual kits

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will be packed in the surplus-kit bag in two layers of four kits each, the breeches and olive-drab shirts to be neatly folded and packed on the top and sides of the layers, the jointed cleaning rod and case provided for each squad being attached by the thongs on the inside of the bag.

CLOTHING ALLOWANCE FOR ENLISTED MEN.

539. The aggregate cost of the allowance of clothing in kind is the basis of the annual money allowance to the soldier during his term of enlistment.

MONEY ALLOWANCE FOR CLOTHING DRAWN BY ENLISTED MEN OF THE ARMY, EXCEPT PHILIPPINE SCOUTS.

Initial allowance	$43.05
Monthly share of initial allowance	7.18
Daily share of initial allowance	.24
Semiannual allowance	12.40
Monthly allowance	2.07
Daily allowance	.07
Total money allowance for 4 years	142.26

The above allowance is subject to change.

540. Chevrons, stripes, badges, and identification tag are issued gratuitously. Overcoats, ponchos, slickers, blankets, brassards, oilskin and rubber clothing, as well as certain special clothing provided for troops in Alaska, are issued on memorandum receipt and form no part of the soldier's allowance.

ARMS AND EQUIPMENT OF THE INFANTRY.

541. (*a*) For mounted orderlies (privates of headquarters company) and corporal of supply company: 1 can, bacon; 1 can,

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condiment; 1 brush and thong (to be omitted if rifle has spare-part container); 1 canteen; 1 canteen cover, dismounted; 100 cartridges, ball, rifle, caliber .30; 21 cartridges, ball, pistol, caliber .45; 1 cartridge belt, caliber .30; 1 cup; 1 fork; 1 front-sight cover; 1 gun sling; 1 knife; 2 magazines, pistol, extra; 1 magazine pocket, web, double; 1 meat can; 1 oiler and thong case (to be omitted if rifle is provided with spare-part container); 1 pistol; 1 pistol holster; 1 pouch for first-aid packet; 1 rifle scabbard; 1 spoon; 1 pair spurs; 1 set spur straps; 1 United States rifle, caliber .30; 1 wire cutter; and 1 wire-cutter carrier (for mounted orderlies only).

(*b*) For sergeants major, regimental supply sergeants, color sergeants, and also the first sergeant of supply company, same as (*a*) except rifle and accessories thereto, substituting pistol belt for cartridge belt.

(*c*) For members of machine gun company, same as (*a*) except rifle and accessories thereto, adding 1 bolo and scabbard for each man and 4 wire cutters and carriers for the company, substituting pistol belt for cartridge belt.

(*d*) For mess sergeants, supply sergeants, sergeants, corporals, cooks, mechanics, and privates of a company; mess sergeants, supply sergeants, stable sergeants, sergeants, cooks, and horseshoers of headquarters company; and mess sergeants, stable sergeants, cooks, saddlers, and horseshoers of supply company, same as (*a*) except pistol and accessories thereto, rifle scabbard, spurs and straps; adding 1 bayonet and scabbard, 1 haversack, and 1 pack carrier.

Seventeen privates in each rifle company are designated to carry wire cutters in carriers.

The following intrenching tools are carried by designated members of each rifle company: 8 hand axes and carriers, 34 pick mattocks and carriers, 68 shovels and carriers.

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(*e*) For first sergeants and members of bands of headquarters company and first sergeants and buglers of a company, the same as (*a*) except rifle and accessories thereto, spurs and straps, adding 1 haversack and 1 pack carrier, substituting pistol belt for cartridge belt; wire cutters and carriers are carried by company buglers (1 each).

(*f*) Horse equipment for each man mounted on a horse: 1 bridle, curb, model of 1902, and 1 bridle, watering (or 1 bridle, Cavalry, model of 1909); 1 currycomb; 1 feed bag and 1 grain bag (or 1 nose bag); 1 halter headstall; 1 halter tie rope; 1 horse brush; 1 lariat; 1 lariat strap; 1 link; 1 picket pin; 1 saddlebags, pair; 1 saddle blanket; 1 saddle, Cavalry; 1 surcingle.

(*g*) Horse equipment for each man mounted on a mule: 1 currycomb; 1 feed bag and 1 grain bag (or 1 nose bag); 1 halter bridle, model of 1910; 1 horse brush; 1 lariat; 1 lariat strap; 1 link; 1 picket pin; 1 saddle, mule; 1 saddlebags, pair; 1 saddle blanket; 1 surcingle.

(*h*) For men armed with rifle: For every 8 rifles 1 cleaning rod, 1 cleaning-rod case, 1 screw driver.

(*i*) For each squad of a company: 1 hand ax or 1 bolo, and 1 hand-ax carrier or 1 bolo scabbard, to be carried by privates; 2 pick mattocks, 2 pick-mattock carriers, to be carried by privates; 4 shovels, 4 shovel carriers, to be carried by privates; 1 wire cutter, 1 wire-cutter carrier, to be carried by corporal.

Each odd-numbered squad of a company will have 1 bolo and 1 bolo scabbard.

Each even-numbered squad of a company will have 1 hand ax and 1 hand-ax carrier.

(*j*) For wagoner (Infantry) with each authorized wagon of field and combat train, same as (*a*) except rifle and accessories

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thereto, spurs, spur straps, wire cutter and carrier, adding haversack, pack carrier, and substituting pistol belt for cartridge belt.

MISCELLANEOUS EQUIPMENT.

542. Each supply company (troop) carries the following engineer property:

(*a*) One hundred and twenty compasses, watch; 8 for each company or troop and 24 for assignment by regimental commander.

(*b*) Four reconnaissance equipment sets, 1 set for regimental headquarters and 1 set for each battalion or squadron.

(*c*) One intrenching equipment set carried on wagon, tool, escort type. (When regiment is serving in a division this wagon belongs to the Divisional Engineer Train.)

543. Each supply troop carries demolition equipment and demolition supplies, packed on 3 mules, identically loaded. 1 mule for each squadron.

544. NOTE.—For items of the above equipment and supplies see Unit Accountability Manuals.

545. Each company carries the following signal property: 2 field glasses, type A or B; 3 field glasses, type EE; 2 kits, flag, combination, Infantry.

546. Each machine-gun company carries 2 field glasses, type C; 4 field glasses, type EE; 3 kits, flag, combination, standard.

547. Each headquarters company carries 4 field glasses, type EE: 16 kits, flag, combination, standard; 4 kits, Artillery, signal.

548. The following ordnance property is held on "unit accountability" (equipment "A"): 2 telescopic sights with screwdriver wrench for each company; 2 pouches for telescopic sights; 2 rifles for telescopic sight; 30 pouches for adhesive tape and foot powder; 15 pouches for adhesive tape and foot powder for

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machine-gun company; 10 pouches for adhesive tape and foot powder for headquarters company; 1 stencil, personal equipment, each company, machine-gun company, headquarters company, and supply company; 1 range finder, 80 c. m. base, for each battalion; 1 arm repair chest, headquarters company only; 1 pistol-cleaning kit, machine-gun company only; blacksmiths' tools for machine-gun company and supply company; saddlers' tools for machine-gun company and supply company; arm locker, model of 1903 rifle, 1 each for company, headquarters company, and supply company; arm locker, automatic pistol, caliber .45, 1 for machine-gun company; marking outfit, for stamping leather, for machine-gun company; marking outfit, for stamping metal, for machine-gun company; seal stamp, for machine-gun company; stencil outfit, for machine-gun company; arm repair chest, complete, model of 1910, 3 to be carried by headquarters company for use of each battalion.

ARMS AND EQUIPMENT FOR THE CAVALRY.

NEW MODEL EQUIPMENT.

549. (*a*) Arms and equipment of all enlisted men, except buglers and members of bands and machine-gun troops; 1 bandoleer, cavalry; 1 brush and thong (to be omitted if rifle is provided with spare-part container); 1 canteen; 1 canteen cover, dismounted; 90 cartridges, ball, caliber .30; 21 cartridges, ball, pistol, caliber .45; 1 cartridge belt, cavalry; 1 cup; 1 fork; 1 front-sight cover; 1 gun sling; 1 knife; 2 magazines, pistol, extra; 1 meat can; 1 oiler and thong case (to be omitted if rifle is provided with spare-part container); 1 pistol, caliber .45; 1 pistol holster; 1 pouch for first-aid packet; 1 ration bag; 1 rifle cover; 1 rifle, United States, caliber .30; 1 saber; 1 saber

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knot; 1 saber scabbard; 1 spoon; 1 spurs, pair; 1 spur straps, set; 1 stock cover; 1 wire cutter.

(*b*) For members of band: 1 canteen; 1 canteen cover, dismounted; 21 cartridges, ball, pistol, caliber .45; 1 cup; 1 fork; 1 knife; 2 magazines, pistol, extra; 1 meat can; 1 pistol, caliber .45; 1 pistol belt, without saber ring; 1 pistol holster; 1 pouch for first-aid packet; 1 ration bag; 1 spoon; 1 spurs, pair; 1 spur straps, set.

(*c*) For first sergeant of headquarters troop (drum major), in addition to (*b*): 1 saber; 1 saber knot; 1 saber scabbard.

(*d*) For members of machine-gun troop, in addition to (*b*): 1 bolo; 1 bolo scabbard; 1 wire cutter.

(*e*) For noncommissioned staff officers and first sergeants, in addition to (*a*): 1 record case, noncommissioned officer's.

(*f*) For buglers, in addition to (*b*): 1 wire cutter.

(*g*) Horse equipment for each enlisted man individually mounted on a horse: 1 bridle, cavalry; 1 carrier strap; 1 cooling strap; 1 currycomb; 1 feed bag; 1 grain bag; 1 horse brush; 1 intrenching tool carrier (only for men of troop and headquarters troop armed with rifle); 1 lariat; 1 picket pin, 1 picket-pin case (only for men armed with rifle); 1 picket-pin carrier, special (only for men without rifle); 1 pommel pockets; 1 ration bag retaining strap,[1] special (for men not armed with saber); 1 rifle carrier (only for men armed with rifle); 1 saber carrier (only for men armed with saber); 1 saddle; 1 saddle blanket.

(*h*) Horse equipment for each enlisted man individually mounted on a mule: 1 carrier strap; 1 cooling strap; 1 currycomb; 1 feed bag; 1 grain bag; 1 halter bridle; 1 horse brush;

[1] This strap is to be attached to the off cantle hinge by means of the billet and buckle; the depending billet buckles to the carrier strap. The ration bag is secured to the D ring.

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1 lariat; 1 picket pin; 1 picket-pin case; 1 pommel pocket; 1 rifle carrier boot; 1 saber carrier; 1 saddle, mule; 1 saddle blanket.

(*i*) Intrenching tools for members of the troop and headquarters troop (except band): Hatchet and hatchet cover, 1 per sergeant (does not include N. C. S. O. or first sergeant). Pick, cavalry, and pick cover, 1 for every 4 men (except sergeants and buglers). Shovel, 3 for every 4 men (except sergeants and buglers).

(*j*) For men armed with rifle: For every 8 rifles 1 cleaning rod, 1 cleaning-rod case, 1 screw driver.

(*k*) For wagoner for each authorized wagon of the field and combat train: 1 canteen; 1 canteen cover, dismounted; 21 cartridges, ball, pistol, caliber .45; 1 cup; 1 fork; 1 knife; 2 magazines, pistol, extra; 1 meat can; 1 pack carrier; 1 pistol belt without saber ring; 1 pistol holster, caliber .45; 1 pouch for first-aid packet; 1 spoon.

MISCELLANEOUS EQUIPMENT FOR THE CAVALRY.

550. Each troop carries the following ordnance property:

Two pouches, telescopic sights.
Two rifles for telescopic sights.
Two telescopic sights, with screw-driver ring.
Record case, noncommissioned officers: Troop, 1; headquarters troop, 7; machine-gun troop, 1; supply troop, 4.
Stencil, personal equipment: Troop, 1; headquarters troop, 1; machine-gun troop, 1; supply troop, 1.
Stencil, wagon: Headquarters troop, 1.
Range finder, 80 c.m. base, with carrying piece and tripod: Machine-gun troop, 1.
Arms repair chest, complete, model 1910: Headquarters troop, 1.
Pistol-cleaning kit: Machine-gun troop, 1; supply troop, 1.

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Troop pannier: Troop, 1; headquarters troop, 1; machine-gun troop, 1; supply troop, 1.

Officer's horse equipment, sets: Troop, 3; headquarters troop, 7; for staff officers, veterinarians, and chaplains, machine-gun troop, 4; supply troop, 3.

Intrenching tools:

Hatchets: Troop, 8; headquarters troop, 6.

Hatchet covers: Troop, 8; headquarters troop, 6.

Picks, Cavalry: Troop, 24; headquarters troop, 11.

Pick covers: Troop, 24; headquarters troop, 11.

Shovels, Cavalry: Troop, 72; headquarters troop, 33.

Sledge hammers: Troop, 1; headquarters troop, 1; machine-gun troop, 1; supply troop, 1.

Steel tape, 5-foot: Troop, 1.

Wire cutters: Troop, 105; headquarters troop, 57; machine-gun troop, 91; supply troop, 14.

Marking outfit, for leather: Headquarters troop, 1.

Marking outfit, for metal: Headquarters troop, 1.

Stencil outfit: Headquarters troop, 1.

Saddlers' and blacksmiths' tools: These tools are issued complete, boxed for each troop, headquarters troop, machine-gun troop, and supply troop. Complete list with each box, and may also be found in the Cavalry Unit Accountability Manual.

ARMS AND EQUIPMENT FOR THE FIELD, HORSE, AND MOUNTAIN ARTILLERY.

551. (*a*) For enlisted men individually mounted, including members of band and for drivers: 1 can, bacon; 1 canteen; 1 canteen cover, dismounted; 21 cartridges, ball, pistol; 1 cup; 1 fork; 1 knife; 2 magazines, pistol, extra; 1 meat can; 1 pistol; 1 pistol belt without saber ring; 1 pistol holster; 1 pouch for first-aid packet; 1 spoon; 1 spurs, pair; 1 spur straps, set.

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(*b*) For cannoneers or dismounted men: 1 can, bacon; 1 can, condiment; 1 canteen; 1 canteen cover, dismounted; 21 cartridges, ball, pistol; 1 cup; 1 fork; 1 haversack; 1 knife; 2 magazines, pistol, extra; 1 meat can; 1 pistol; 1 pistol belt without saber ring; 1 pistol holster; 1 pouch for first-aid packet; 1 spoon.

For dismounted men of the mountain artillery (except members of band) same as (*b*), adding 1 bolo and scabbard.

(*c*) Horse equipment for each man mounted on a horse: 1 bridle, field artillery; 1 currycomb; 1 feed bag; 1 grain bag; 1 halter headstall; 1 halter tie rope; 1 horse brush; 1 link; 1 saddle, McClellan, field artillery; 1 saddlebags, pair; 1 saddle blanket; 1 surcingle.

(*d*) Horse equipment for each driver: 1 currycomb; 1 horse brush.

(*e*) For each draft horse in addition to harness: 1 feed bag; 1 grain bag; 1 surcingle.

(*f*) For each spare horse: 1 feed bag; 1 grain bag; 1 halter headstall; 1 halter tie rope; 1 saddle blanket; 1 surcingle.

(*g*) Horse equipment for each man mounted on a mule (mountain artillery): 1 currycomb; 1 feed bag; 1 grain bag: 1 halter bridle (with leather reins); 1 horse brush; 1 link; 1 saddle, mule, riding; 1 saddle bags, pair; 1 saddle blanket; 1 surcingle.

(*h*) For pack mules in addition to pack harness (mountain artillery): 1 currycomb; 1 feed bag; 1 grain bag; 1 horse brush; 1 surcingle.

(*i*) For bell and spare horses and spare mules (mountain artillery): 1 feed bag; 1 grain bag; 1 halter headstall; 1 halter tie rope; 1 saddle blanket; 1 surcingle.

(*j*) Under the provisions of paragraph 1522 A. R. 1917, organization commanders may keep on hand a sufficient num-

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ber of complete sets of pistols and accessories for issue to officers.

The pistol ammunition required will be taken from the ammunition which is held by the organization commander for authorized instruction, firing, or target practice.

MISCELLANEOUS EQUIPMENT.

552. For lists of engineer, signal, and ordnance property held on unit accountability, see Unit Accountability Equipment Manuals of the several types and caliber of guns and howitzers.

ARMS AND EQUIPMENT FOR THE ENGINEERS.

NEW MODEL EQUIPMENT (1910).

553. (*a*) Arms and equipments for all enlisted men, except those specified in paragraphs (*d*), (*e*), and (*f*) below: 1 United States rifle, caliber .30; 1 brush and thong; 1 oiler and thong case; 1 front-sight cover; 1 bacon can; 1 canteen; 1 canteen cover, dismounted; 80 cartridges, ball, caliber .30; 1 cup; 1 condiment can; 1 gun sling; 1 meat can; 1 knife; 1 fork; 1 spoon; 1 pouch for first-aid packet.

(*b*) Mounted men (except those specified in paragraphs (*d*), (*e*), and (*f*) below) will have in addition to (*a*): 1 cartridge belt, caliber .30, mounted; 21 cartridges, ball, pistol, caliber .45; 1 pistol; 1 pistol holster; 2 magazines, pistol, extra; 1 magazine pocket, web, double; 1 spurs, pair; 1 spur straps, set.

(*c*) Dismounted men (except those specified in paragraphs (*d*), (*e*), and (*f*) below) will have in addition to (*a*): 1 bayonet; 1 bayonet scabbard; 1 cartridge belt, caliber .30, dismounted; 1 haversack; 1 pack carrier.

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(*d*) For sergeants major, master engineers, senior and junior grade, regimental and battalion supply sergeants, sergeants, first class, color sergeants, sergeants bugler, company buglers, and members of band: 1 pistol; 1 pistol belt, without saber ring; 1 pistol holster; 2 magazines, pistol, extra; 21 cartridges, ball, pistol, caliber .45; 1 haversack and 1 pack carrier, if dismounted; 1 canteen; 1 canteen cover, dismounted; 1 cup; 1 bacon can; 1 condiment can; 1 knife; 1 fork; 1 spoon; 1 pouch, for first-aid packet; 1 meat can; 1 pair spurs and 1 set spur straps, if mounted.

(*e*) For first sergeants in addition to (*d*): 1 pouch for Weldon range finder; 1 steel tape, 60-foot; 1 steel tape, 5-foot; 1 Weldon range finder.

(*f*) For wagoner (engineer) with each authorized wagon of field and combat train: 1 pistol; 1 pistol belt, without saber ring; 1 pistol holster; 2 magazines, pistol, extra; 21 cartridges, ball, pistol, caliber .45; 1 haversack; 1 pack carrier; 1 canteen; 1 canteen cover, dismounted; 1 cup; 1 bacon can; 1 condiment can; 1 knife; 1 fork; 1 spoon; 1 pouch, for first-aid packet; 1 meat can.

(*g*) Horse equipment for each enlisted man individually mounted on horse: 1 cavalry bridle, or curb bridle, model of 1902; 1 watering bridle (issued only with model of 1902 curb bridle); 1 currycomb; 1 feed bag; 1 grain bag; 1 halter headstall; 1 halter tie rope; 1 horse brush; 1 lariat; 1 lariat strap; 1 link; 1 picket pin; 1 rifle scabbard (if armed with rifle); 1 saddle, cavalry, complete; 1 pair saddlebags; 1 saddle blanket; 1 surcingle.

(*h*) For men armed with rifle: Cleaning rod, cleaning-rod case, screw driver, 1 for every 8 rifles.

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(*i*) For officers entitled to horse equipment, see par. 1520, A. R., 1917.

(*k*) Pistol equipment for use of officers under A. R. 1522.

MISCELLANEOUS EQUIPMENT FOR THE ENGINEERS.

554. In addition to the individual and horse equipment listed above, the following ordnance property is carried, as follows:

Stencil, personal equipment: Band, 1; company, 1; battalion headquarters, 1; regimental headquarters, 1.

Pistol-cleaning kit: Band, 1.

Wagon stencil: Regimental headquarters, 1.

Saddler's tools (equipment "A") for both dismounted and mounted organizations, as per Engineers Unit Accountability Equipment Manual.

555. The following articles of equipment "B" for both dismounted and mounted organizations is carried in the field by regimental or battalion headquarters as equipment "A":

Cleaning rods: 20 for company, dismounted; 13 for company, mounted.

Marking outfit for leather and marking outfit for metal: 1 each for company and regimental headquarters, dismounted, and 1 each for company, mounted.

Stencil outfits: For dismounted organizations, 2 for regimental headquarters; for mounted organizations, 1 for battalion headquarters.

Arm chests complete, model 1910: 2 for the regimental headquarters; 1 for battalion headquarters, mounted.

556. The following signal property is carried by each company of dismounted and mounted Engineers: Kits, flag, combination, standard, 4; glasses, field, type A (or type B), 2.

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FIELD BATTALION, SIGNAL TROOPS.

557. Officers, arms, and equipment as for officers, mounted.

558. Enlisted men, mounted and dismounted, are armed with pistol.

ALL ARMS.

559. The following equipment of the soldier mounted applies to all arms with slight modifications:

Equipment on person:

1 pistol in holster, strap around leg.
1 cartridge belt and suspenders.
2 pistol magazines, extra.
1 magazine pocket, double.
Rounds of ammunition, rifle: 90 cavalry, 100 infantry, 80 engineers.
21 rounds of ammunition, pistol.
1 first-aid packet in pouch.
1 identification tag (worn under the shirt suspended from a cord around the neck).
2 spurs and straps.
Wire cutters: 1 for each trooper; 1 for each infantry squad.
1 Weldon range finder in pouch. (By designated bugler on belt. In lieu of this the new 80 c. m. base range finder will be carried on combat train when issued.)
1 steel tape, 60 feet (in left saddle pocket by bugler carrying range finder).
2 pistol belts (worn by buglers).
4 kits, flag, combination (by buglers and 2 designated signalmen, strap over right shoulder).

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Equipment on person—Continued.

2 bugles, with slings (by buglers, sling over left shoulder).
2 glasses, field, type A or B (by buglers, strap over right shoulder).
6 compasses, watch (by sergeants, in right shirt pocket).
3 glasses, field, type EE (by first sergeant and two senior duty sergeants (strap over left shoulder).
7 whistles and chains (by sergeants, in left shirt pocket).
1 guidon, service, with case and staff.
1 guidon, silk, with case and staff (occasion for use see par. 235 A. R.).
2 telescopic sights with screw-driver wrench (by designated expert shots).
2 rifles for telescopic sights (by designated expert shots).
2 pouches, telescopic sight (by designated expert shots).
1 horseshoer's emergency equipment (carried on horse by horseshoers)—
1 pincers.
1 shoeing hammer.
1 hoof knife.
1 jointed horseshoe, No. 2.
1 rasp.
Horseshoe nails, assorted.
½ pound oakum.
1 4-ounce bottle, chloro-lin or kreso.

Clothing and equipment on horse:

1 bridle, complete, and link.
1 halter and tie rope or strap.
1 saddle, complete.
1 saddle blanket.
1 rifle in scabbard (on near side).

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Clothing and equipment on horse—Continued.

1 gun sling (on rifle).
1 front-sight cover (on rifle).
1 oiler and thong case containing thong and brush and sperm oil (in butt of rifle).
1 saber and scabbard with saber knot (on right side, sloping at an angle of 45°).
2 saber straps.
1 feed bag with grain bag containing feed of grain for noon feed inclosed (strapped on pommel above the slicker).
1 surcingle (passing over saddle and under quarter straps).
1 picket pin and lariat (coiled and fastened to near cantle ring by lariat strap).
1 lariat strap.
1 canteen, strap, and cup (strap through handle of cup and snapped in off side cantle ring).
1 slicker (rolled and strapped on pommel).
1 saddlebags (straps buckled in cincha rings) containing:

Left side—
1 meat can.
1 knife.
1 fork.
1 spoon.

Right side—
1 horse brush.
1 currycomb.
2 fitted horseshoes (wrapped in cloth).
16 nails, horseshoe (in oiled cloth).

Reserve rations and other extra articles in saddle bags should be so distributed between the two pockets as to balance the weight on the horse.

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Clothing and equipment on horse—Continued.

1 blanket roll (44 inches long, 6 inches in diameter, and ends pressed inward) containing—

1 shelter tent, half.
5 shelter-tent pins.
1 shelter-tent pole.
1 shelter-tent rope.
1 blanket.
1 comb.
1 drawers.
2 pairs stockings.
1 toothbrush.
1 towel.
1 cake soap.
1 undershirt.
1 housewife (by squad leader only).

560. Fundamental company equipment, variable with strength, carried on wagons: Two rakes, steel; 1 bag, water, sterilizing; bars, mosquito, single (1 for 2 men); 7 headnets, mosquito (for guard only; if no mosquito bars are furnished, 1 per man); 2 buckets, G. I.; 2 lantern frames, combination; 2 globes, lantern; 2 wicks, lantern; 1 chest, anvil and block, and 1 chest, forge cavalry (for list of tools, see p. 23, C. U. A. E. M.); shoes, horse, extra, 73 pounds; nails, horseshoe, 15 pounds (in small box packed in forge chest); calks, toe horseshoe, 1 per shoe (supplied when necessary); coal, smithing, 25 pounds; 1 stretcher, shoe; 1 company barber kit; soap, 13 pounds (issued as required); matches, 24 boxes; candles, lantern (as ordered by C. O.); powder, hypochlorite of lime, 50 tubes (issued as

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required); oil, mineral, 3 gallons (issued as required); salt, rock, 14 pounds.

Forage: On each vehicle, reserve of one day's grain; in ration section of field train, 2 days' grain.

Rations: In ration section of train, 2 days' field, 1 day's reserve.

Saddler's tools, 1 set (for list of tools see C. U. A. E. M.).

One picket line, 250 feet ¾-inch; 5 picket pins; and 1 sledge hammer; on pack horse if available.

One stencil, canteen.

One farrier's field equipment to be used until pannier is furnished (limit of weight, 18 pounds).

For list of medicines for 100 animals for 10 days, see page 561, G. O., No. 39, W. D., 1915.

Cooking utensils, 1 set: One cake turner; 1 cleaver, meat; 1 flour sieve; 1 fork, meat, large; 1 knife, butcher; 1 ladle, soup; 1 fire irons (or grate) set (20 pounds); 3 kettles, camp; 3 pans, bake; 1 pan, dish.

One kit saddler's supplies, limit of weight, 30 pounds. (List of articles not prescribed.)

Three company repair kits and spare parts, rifle. To be used until arm-repair chest is supplied. Carried by headquarters company or troop.

One pistol-cleaning kit and spare parts, pistol. To be used until arm-repair chest is supplied.

One box cleaning material (to be used until arm-repair chest is supplied).

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561. ALLOWANCE OF TENTAGE AND BAGGAGE.

	A. Tentage.		B.	C.	D.
	Small pyramidal tents.	Shelter tents, complete.	Messing and cooking outfits.	Officers' bedding and clothing rolls.	Records and all other requisites.
1. Headquarters of an army or field army (as prescribed by commander)	*Number.*	*Number.*	*Pounds.*	*Pounds.*	*Pounds.*
2. Headquarters of a division or brigade			100		800
For personal use and office of—					
(a) Commander	1			100	
(b) Every two staff officers	1			100	
3. Regiment:					
Artillery					2,000
Infantry					2,500
Cavalry					7,000
(a) Each field officer	1			50	
(b) Each captain, lieutenant, and veterinarian		1		50	
(c) Each company, troop, battery, and band, per man			1		
4. Independent battalion					500
(a) Each field officer	1			50	
(b) Each captain, lieutenant, and veterinarian		1		50	
(c) Each company, troop, or battery, per man			1		
5. A supply, ammunition, sanitary, or engineer train and column					300
(a) Every two field officers	1			100	
(b) Each captain, lieutenant, and veterinarian		1		50	
(c) For every 100 men of train personnel			100		

NOTE.—Each enlisted man and attached civilian employee carries a shelter-tent half.

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BOOKS AND BLANK FORMS.

562. For each company, troop, and battery the following books and blanks are recommended: 1 field desk (limit of weight, 30 pounds), containing 1 Army Regulations, 1 Drill Regulations, 1 Field Service Regulations, 1 Manual for Courts-Martial.

Number required.	Description.	Form No.
	THE ADJUTANT GENERAL'S DEPARTMENT.	
10	Statement of service	15
5	Certificate of disability for discharge	17
2	Discharge certificate (without honor) [1]	19
2	Discharge certificate (dishonorable) [1]	20
6	Field return	26
10	Service records (in addition to the current file)	29
4	Return of troops	30
4	Inventory of effects of deceased soldier	34
6	Muster roll (in addition to retained roll)	61
10	Final statements [1]	62
2	Furloughs	66
12	Descriptive list of deserters	95
20	Record of summary court (in addition to current file)	99
5	Report of casualties in action	149
3	Report of survey	196
5	Discharge certificate (honorable) [1]	203
2	Morning report (in addition to one in use)	332
2	Daily sick report (in addition to one in use)	339
2	Duty roster (in addition to one in use)	342
10	Designation of beneficiary of officer or enlisted man	380
1	Correspondence book	
10	Reservists descriptive card	443
5	Notification of transfer to reserve	559
	QUARTERMASTER CORPS.	
6	Pay roll (cover) in addition to retained rolls	28
16	Pay roll (inside sheets)	28A

[1] Par. 150, A. R., 1917, requires discharge certificates and final statements to be kept in personal custody of troop commander.

For field desk allowance of stationery see p. 565, G. O. 39, W. D., 1915.

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Number required.	Description.	Form No.
	QUARTERMASTER CORPS—continued.	
4	Advice of soldier's deposits	8A
5	Soldier's deposit book (in addition to current file)	41
1	Ration return (book of 25 sheets)	323
	Descriptive list of public animals (current file only)	227
5	Official telegrams	406
1	Annual price list of clothing and equipage	.....
	Stationery [1]	.....
	ORDNANCE DEPARTMENT.	
6	Monthly report of charges on muster and pay rolls	94
4	Transfer of ordnance property	146
4	Requisition for ordnance	286
1	Price list of ordnance property	1079

[1] Par. 150, A. R., 1917, requires discharge certificates and final statements to be kept in personal custody of troop commander.
For field desk allowance of stationery see p. 565, G. O. 39, W. D., 1915.

SUGGESTIONS TO OFFICERS WHO HAVE NOT HAD FIELD SERVICE.

563. The field baggage allowance is 50 pounds. A shelter tent complete, a bedding roll, and a blanket are essential; a clothing roll is a convenience. All may be purchased from the depot quartermaster, Philadelphia.

564. The following articles may be purchased at military equipment stores: 1 bedding roll; 1 clothing roll; 1 shelter tent (complete); 1 mosquito bar; 1 blanket; 1 canvas bucket and 1 canvas basin; 1 housewife and 1 first-aid packet; 1 lantern (and candles); 1 extra pair marching shoes (with extra laces); 1 poncho or raincoat or cape; underwear and light woolen socks; toilet articles; foot powder and can of adhesive plaster, 1 inch wide; writing materials; 1 identification tag; 1 compass; 1 heavy pocketknife.

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The above articles (underwear, etc., in reasonable quantity) will not exceed in weight the field baggage allowance.

PERSONAL HYGIENE AND CAMP SANITATION.

THINGS THAT EVERY OFFICER AND MAN CAN DO TO PRESERVE HIS OWN HEALTH.

565. Nearly all diseases to which the soldier is subject are caused by germs. These germs are little animals or little plants so small that they can not be seen with the naked eye. They are of various kinds and are present in the air, in the earth, in food, in water, and they may be present on one's skin or clothing or on objects which one touches. Not all germs are harmful, but many may produce serious diseases upon finding entrance into the body. They may be taken into the body in the air we breathe or in the food and water we drink, or they may be carried to the mouth by dirty hands. Where the skin is cut or broken they may find entrance directly through the wound and certain germs may be injected directly into the body by the bite of insects, such as mosquitoes, flies, lice, bedbugs, and fleas. In order to keep off disease the following rules must be observed:

CLEANLINESS.

566. A dirty body is one of the commonest causes of disease. Dirt on the hands may mean poison in the food. The hands, therefore, must be frequently washed, always before meals and after urinating or visiting the toilet. All dirt must be removed and kept removed from under the finger nails. This is best done by means of a dull toothpick or stick, because a sharp knife blade scratches the underside of the nail and the dirt collects more quickly.

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The skin serves as a general covering for the body to protect the delicate parts underneath; through its pores the body throws off much of the poisonous and waste matter which must be gotten rid of every day. This waste matter lodges upon the surface of the skin, and unless frequently removed it clogs up the pores and prevents other waste matter from being thrown out. The entire body should be bathed, therefore, whenever possible. Where bathing facilities are not available the body should be scrubbed with a wet cloth frequently.

567. Remember that dirty clothes mean a dirty body; clean them as often as you can. If water is not available, crumple up the clothes, shake them well, and sun-dry them if possible. Underclothing should be washed at least once a week, oftener if practicable.

568. *Vermin may be killed with gasoline, or by hot ironing or scorching underclothing.*—It is comparatively simple, by attention to personal cleanliness, to destroy full-grown lice; but the eggs are killed with difficulty, for they are deposited in the seams of underclothing, trousers, etc. Brush thoroughly, apply heat, or rub in the special grease (vermijelli), which smothers the young on emerging from the eggs. Dust also with vermin powder.

CARE OF THE MOUTH.

569. Unless the teeth are kept clean certain germs which are present in all mouths will cause the teeth to turn yellow or black and the gums to soften and bleed. If this condition is allowed to go on unchecked the teeth will eventually fall out. It is very important, therefore, that the teeth be scrubbed twice a day with a fairly stiff brush and a tooth powder or tooth paste. Particles of food which collect between the teeth should be promptly removed with a wooden toothpick.

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CARE OF THE FEET.

570. It is especially important that the feet be kept clean. Marching causes the feet to perspire freely and throw off waste matter which soon putrefies and becomes foul smelling. Sweaty feet and dirty feet are more easily blistered because the skin is softer. The feet should therefore be well washed every night, and if this daily washing does not keep the feet from sweating or does not keep them from smelling badly, a little foot powder dusted in the shoes every morning will dry the perspiration, harden the skin, and prevent odor. Or in severe cases a weak solution of formol for washing the feet may be obtained from the medical officer.

571. In addition to keeping the feet clean it is essential to have a well-fitting shoe. In getting shoes, always be sure to see that they are properly fitted.

572. The proper wearing of the sock is almost as important as a properly fitting shoe. Socks that are too short cramp the toes, and socks that are too long wrinkle and are liable to rub and blister the foot. Be sure that the socks are smooth inside of the shoe. Socks should be taken off at the end of the march, be flattened out, and well shaken. Put on a clean pair if possible; if not, put the left sock on the right foot, and vice versa.

573. Should a foot blister on the march do not continue walking until it has been protected. Remove the shoe and sock, and if the blister is still unbroken, prick it with a clean pin and allow the fluid to escape. Then place a piece of adhesive plaster over the entire blister. If the blister has already broken, protect the raw spot in the same way with adhesive plaster.

574. Corns are due to pressure and when the pressure is removed the corn will disappear. If one has properly fitting shoes, he will not have corns. If, however, a corn does appear, get a

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felt corn plaster and stick it on the foot around the corn. After two or three days replace the corn plaster with a new one, and in a little while the corn will "come out."

EATING AND DRINKING.

575. A great many diseases of the soldier are due to imprudent eating and drinking. *Do not eat too much. Do not rush through your meals. Do not eat food the quality of which is at all doubtful.* Food from street lunch stands, "night lunches," dirty restaurants, etc., is quite likely to be bad.

576. Never start on the march with an empty stomach if you can help it.

577. Never go on outpost or any detached duty without enough food to carry you over your probable time of absence, with a margin.

578. Do not drink water which has not been certified to by the authorities as pure, until it has been boiled or treated with chloride of lime powder. *Always use your own drinking cup or canteen.* Remember that diseases can be transferred by a common drinking cup.

579. Always start on the march and go on outpost or trench work with your canteen full. Cold, weak tea (without milk or sugar) tends to assuage thirst.

580. Do not drink as soon as you feel thirsty; the oftener you drink the thirstier you will become. Drink as little as possible at a time, more especially if you are hot, and make up your mind to arrive at the end of a march with some water still left in your canteen.

TO KEEP THE CAMP CLEAN.

581. Never throw pieces of food or other refuse around the camp or trench. They will draw flies and flies frequently carry

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disease. Never urinate or defecate except in sinks or receptacles provided for that purpose. If open sinks are used cover at once with earth. If buckets or other receptacles are used, see that the covers are properly replaced. Any man who does not observe this rule is exposing himself and his comrades to great danger of disease. Urine is just as dangerous as solid matter.

FIRST AID.

582. Every officer and man should at all times carry on his belt a first-aid packet in good condition. If wounded, the tin container should be opened and the dressing promptly applied without touching the wound with the fingers.

TREATMENT OF CASES OF EMERGENCY.

583. *Artificial respiration* (v. under *Drowning*).

584. *Bleeding.*—Bleeding may be either external or internal, and may be arterial or venous.

(*a*) *Arterial bleeding.*—The blood is of a bright-red color, and at first escapes in spurts.

Treatment.—Expose the wound, apply the gauze of the first-aid packet, and first try pressure on the bleeding point with the fingers over this protection; if this fails, compress the artery against the bone close to the wound, but between it and the heart. Pressure should be maintained until some more permanent means can be employed (such as an improvised tourniquet), or medical assistance procured.

Absolute rest is essential. If the bleeding is from a limb, raise it.

(*b*) *Venous bleeding.*—The blood is of a dark color; it flows or oozes out, but there is no appearance of pulsation.

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Treatment.—Lay the patient down, remove any constriction which may be round the limb, elevate the limb, and apply a pad and firm bandage.

The following table shows the situation of the main arteries and their treatment when wounded:

Position.	Name of artery.	Treatment.
Head	Temporal and facial	Apply first-aid dressing over the wound and bandage tightly.
Armpit	Axillary	Compress artery downward and backward behind the middle of the collar bone.
Arm (on inner side in line with the seam of the sleeve).	Brachial	Compress the artery by hand.
Thigh	Femoral	Pressure in the groin by fingers or tourniquet.

An improvised tourniquet may be made as follows: Take a handkerchief, a smooth rounded stone, and a stick or bayonet scabbard, etc., wrap up the stone in the center of the handkerchief, tie a knot over it, and place the stone over the artery, pass the ends of the handkerchief around the limb and tie them securely, leaving sufficient space for the stick to be admitted; pass the stick then between the handkerchief and the skin and carefully twist it until, by tightening the handkerchief, the stone is pressed upon the artery with sufficient force to arrest the flow of blood. A pad should be placed between the stick and the skin to prevent the latter being bruised, and the end of the stick must be secured with a bandage to prevent the tourniquet untwisting.

The tourniquet should be applied no tighter than is absolutely necessary to stop the arterial bleeding and should only be used

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as a last resource. A medical officer must be sent for as soon as possible.

Internal bleeding.—The symptoms of internal hemorrhage are prostration and weakness. The surface of the body is cold and the face pale, the lips lose their color. The pulse is weak or imperceptible; there is sighing respiration and a cold, clammy sweat.

Keep the patient absolutely quiet and do not give stimulants.

585. *Bowel complaints.*—Any disorder of the bowels should at once be brought to the notice of the medical officer. Diarrhea is often the first symptom of more serious disease.

586. *Broken limbs.*—Gently put the broken limb straight after cutting off the clothes, then fix it in this position by means of a rifle, roll of newspapers, pieces of wood, etc. If no splints are available, or when time is an important factor, simply—in the case of a leg—fix the broken limb to the sound one; and in the case of the arm fix to the chest, using in the former the sound limb and in the latter the chest to act as a splint. In fixing a broken limb care should be taken not to bandage too tightly, as during the first 24 hours considerable swelling of the part is likely to take place.

A collar-bone fracture should be treated by bandaging the arm across the chest, so that the hand rests on the opposite shoulder. The elbow should be free, but the forearm and arm bandaged across the chest.

Splints are required for the treatment of broken limbs. They are made of any unyielding substance, such as wood, bark, bundles of twigs, wire, rifles, bayonets, swords, etc. They should be padded with some soft material. They are bound to the limb with bandages, tapes, etc., but care should be taken not to bandage immediately over the site of fracture. Cases of suspected fracture should not be moved without first applying a splint.

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587. *Burns and scalds.*—If severe a medical officer should be sent for at once. Death from shock may occur unless treatment for this is immediately undertaken—rest and warmth by means of blankets and hot-water bottles or by immersion in a warm bath. Then, when the warmth of the body is thoroughly restored, attention should be directed to the local conditions, being careful to expose for this purpose only one limb at a time. Dressings of simple aseptic or nonirritating antiseptic oils, or ointment or vaseline, spread on muslin or similar light materal, should be applied and covered with absorbent wool and bandage. Slight cases should just be dressed as above. Cover from the air. Slices of potato can be applied with advantage to the wounds if slight.

588. *Death, signs of.*—(*a*) Respiration ceased: May be tested by applying mirror to lips or feather to mouth, or by the movement or otherwise of a glass of water on abdomen.

(*b*) Circulation ceased: No pulse at wrist, heartbeat not felt or heard.

(*c*) Face: Fixed sculptural expression.

(*d*) Condition of eyes: Loss of transparency and of elasticity of eyeball.

(*e*) Pallor of skin: Doughy, inelastic feel.

(*f*) Discoloration of skin on dependent parts after a time.

(*g*) Muscles are flabby immediately after death but rigid afterwards (rigor mortis).

(*h*) Decomposition setting in is an absolute sign of death. Green color of the abdomen is the first indication.

Interval of time after death:

(1) If body is rigid, death probably has occurred longer than 3 hours.

(2) If there are discolored patches on dependent parts, longer than 8 hours.

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(3) If putrefaction has set in, longer than 12 hours.

(4) If rigidity has passed off, longer than 16 hours.

589. *Dislocation.*—Dislocation will be recognized by deformity being present at a joint. Reduction should be left to the medical officer. Support the part and keep it at rest.

590. *Drowning.*—Restoration by Schäfer method. If breathing has ceased, immediately on removal from the water place the patient face downward on the ground, with the arms drawn forward and the face turned to the side. Then, without stopping to remove or loosen clothing, commence artificial respiration. To effect artificial respiration put yourself astride or on one side of the patient's body, in a kneeling or squatting position, facing his head. Placing your hands flat on the small of his back, with the thumbs parallel and nearly touching, and the fingers spread out over the lowest ribs, lean forward with the arms straight and steadily allow the weight of your body to fall on the wrists, and so produce a firm, downward pressure, which must not be violent, on the loins and the lower part of the back. This part of the operation should occupy the time necessary to count, slowly, *one, two, three.* By this means the air (and water, if there be any) is driven out of the patient's lungs. Water and slime from the air passages may also run out. Immediately after making the downward pressure swing backward so as to relax the pressure and allow air to enter the lungs. Do not lift the hands from the patient's body. This part of the operation should occupy the time necessary to count, slowly, *one, two.* Repeat this forward and backward movement (pressure and relaxation of pressure) 12 or 15 times a minute, without any marked pause between the movements. Whilst the operator is carrying out artificial respiration others may, if there be opportunity, busy themselves with applying hot flannels, hot bottles, etc., between the thighs and to the armpits and

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feet, or promote circulation by friction, but no attempt should be made to remove wet clothing or give restoratives by the mouth till natural breathing has recommenced. When this has taken place, allow the patient to lie on the right side and apply friction over the surface of the body by using handkerchiefs, flannels, etc., rubbing legs, arms, and body all toward the heart, and continue after the patient has been wrapped in blankets or dry clothing. As soon as possible after complete recovery of respiration remove patient to nearest shelter. On restoration, and if power of swallowing has returned, small quantities of warm coffee, tea, milk, wine, etc., may be given. Encourage patient to sleep, but watch carefully for some time, and allow free circulation of air around patient.

NOTE.—Artificial respiration must also be resorted to in case of suffocation by charcoal fumes or coal gas, mining accidents, hanging, lightning stroke, and severe electric shock.

591. *Fainting.*—Lay patient on his back, with the head low. Loosen clothing. Allow plenty of fresh air.

592. *Feeling faint.*—Sit down, and put head between knees.

593. *Fits.*—Lay patient on his back, with the head slightly raised. Loosen the clothes about the neck and chest and prevent him from biting his tongue by placing the handle of a toothbrush, or similar article, as a gag, between his teeth. Employ sufficient restraint only to prevent him injuring himself. Do not give stimulants. He will come to in time.

594. *Fractures* (v. *Broken limbs*).

595. *Frostbite.*—Frostbite and numbness occur most frequently when there is lack of food and sleep. They may be prevented by movement, because the circulation is then increased. Therefore, even on sentry duty, keep moving about and do not stand still. The fingers, toes, ears, and nose are the parts of the body usually attacked by frostbite, as the circulation of the

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blood is slowest there. These parts should therefore be smeared with grease before trench work. Whenever these parts begin to feel frozen begin to rub.

In real frostbite, the part affected becomes a dead white, often without the person noticing it.

Drinking alcohol gives temporary warmth, but its after-effects are to lower the temperature of the body. Therefore, alcohol should be avoided if one is going to be exposed to cold.

The first symptom of frostbite is generally cold in the part, then pain, then loss of sensation. When any of them are present, it is bad to warm the part before the fire. Rub it instead with a dry glove, or with snow, or a cloth steeped in water and wrung dry. After the part has been rubbed well, dry it well and smear it with grease. If the symptoms continue, the part will become swollen and change color. If this occurs it is dangerous, and the soldier must report at once to the surgeon.

If a comrade falls down unconscious, affected by the cold, the following steps must be taken while waiting the arrival of the surgeon: Warm wraps must not be put over him and he must be kept away from the fire. If possible, carry him into a room or place without a fire, remove the clothes, and rub hard with a cloth soaked in water or snow and wrung dry, and perform artificial respiration. In any case, perform artificial respiration. When consciousness has returned give him some warm tea, cover him up warmly, and let him remain quiet.

596. *Gas.*—Cloud gas (chlorine, phosgene, etc.) is poisonous, causing choking, suffocation, and unconsciousness. Men who are affected by gas, even though wearing masks, must keep their gas masks on, and should be removed into pure air as soon as possible. No man suffering from the effects of gas is

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to be allowed to walk to the dressing station. The gas, being heavy, lies in the bottom of trenches and in dugouts for a considerable time after it has blown away from ground level; it should be removed by antigas fans, masks being kept on until it has all been dispersed. Dugouts may be cleared fairly quickly by a fire in the middle of the floor.

Many gas shells now in use contain lachrymators, which are poisonous, and necessitate the masks being worn.

597. *Gunshot wounds* (v. *Wounds*).

598. *Infectious diseases.*—Isolate the patient, segregate the people who have been in contact with him. Do not forget to make arrangements about their food and water. Before disinfection is carried out, and in order to prevent the clothes, etc., being taken away, placing a seal on the door is a very useful practice. All useless and dirty kit should be burned. Disinfection will be carried out by the order and under the supervision of a medical officer.

599. *Poisoning.*—(*a*) Corrosive: Cause—such acids as vitriol cresol, carbolic acid; or alkalies, as caustic soda, strong ammonia.

Symptoms—great pain, immediately after poison has been swallowed, in mouth and throat, which look as if scalded. Lips stained and blistered. Shock, difficulty of breathing, and breath smells sour.

Treatment—do *not* give emetics. Give, for acids, whitening, chalk, wall plaster, or washing soda, mixed with water; for alkalis, weak vinegar or lime juice. Milk and raw eggs good in either case.

(*b*) Irritant: Cause—decomposed food (ptomaine), arsenic, mercury, phosphorus.

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Symptoms—inflammation and pain in stomach, vomiting, etc.

Treatment—emetics,[1] warm water to wash out; then milk and eggs.

(*c*) Systemic: Cause—opium, narcotics, strychnine, prussic acid.

Symptoms—action on nerves and brain, heart failure, drowsiness, difficulty in breathing.

Treatment—emetics,[1] then stimulants (hot coffee, weak alcohol). If narcotics suspected, walk patient about.

600. *Snake bit or poisoned wound.*—Apply a ligature or tourniquet above the bite, i. e., between it and the heart. Suck the wound.

Make one-half inch deep cruciform incision on the wound with a clean knife and rub in crystals or solution of permanganate of potash or some antiseptic.

Give stimulants, such as brandy, sal volatile, or hot black coffee.

If breathing is bad, artificial respiration should be tried.

601. *Sunstroke or heatstroke.*—Place patient at once in shade or cool place. Allow plenty of fresh air. Raise head and remove clothing from neck and upper part of body. Douche head, neck, and spine, or whole body, with cold water. Do not give stimulants.

602. *Trench foot.*—Is caused by standing about with wet feet in cold weather and also by the constriction of circulation caused by keeping shoes and leggins on for long periods without removing them. Symptoms do not generally appear till the third or fourth day. There is an early loss of sensation, and

[1] A tablespoonful of mustard (or salt) in tumbler of water (warm for choice).

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the feet become puffy and doughy to the feel (œdematous), in bad cases even purple or blue.

To prevent, do not wear tight shoes or leggins, take them off daily, rub well with antifrostbite grease before going into trenches and whilst in trenches, so that the grease is well absorbed by the skin. Keep moving, have dry stockings (rubber boots if possible), change frequently into dry socks, wearing two pairs if feasible. Hot soup, tea, or cocoa at night. Rum or alcohol are comforting but lower the temperature of the body and should not be drunk. Practically the only treatment is to dry, massage twice a day, rest, and keep the feet up. Bad cases may last two months or more.

603. ***Wounds.***—The greatest possible cleanliness is necessary in the dressing of wounds. Any dirt or foreign matter introduced into them greatly increases their danger and the time occupied before they are healed. Every wound gives rise to a certain amount of bleeding. In cases where it is not severe, no particular attention need be paid to it, the pressure effected by the firmly bandaged dressing sufficing to arrest it; where, however, the bleeding is severe and the blood comes out in jets, efforts should be made to arrest it before applying the dressing (v. *Bleeding*). Having stopped the bleeding, apply the first-aid dressing, taking care to use that belonging to the wounded man and not your own.

In dressing the wound interfere with it as little as possible; nothing should come into contact with the wound but the inner layer of the dressing where it has not been handled. If the dressing contains a small tube of iodine, this must be opened and iodine applied to the wound and the surface of the skin around it. (This will smart considerably.) Apply the dressing and bandage firmly on. Do not bandage too tightly, especially over bony parts, such as the wrist or ankle, as there is danger

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to the limb if you do so, as the flow of blood through it may be arrested, and the limb thereby die.

Very many wounds are complicated by fractures or breaks in the bone. In such cases, after the bleeding has been arrested and the wound dressed, splints should be applied to each side of the injured limb in order to keep the ends of the broken bone from rubbing against one another (v. *Broken limbs*). They must be so applied that they fix the ends of the broken bone, and care should be taken not to bandage them on too tightly, nor should a bandage be tied directly over the part where the bone is broken. Take to medical officer as soon as possible.

THINGS AN OFFICER CAN DO TO PRESERVE THE HEALTH OF HIS MEN.

604. On arrival in camp, or on taking up an outpost, see at once to the position of the water supply, and make arrangements for boiling or sterilizing in the water bag.

605. Latrines and urinals should be fixed as soon as possible after arrival at a camp or outpost, and be placed where they can not endanger kitchens or water supply.

Do not let your men ease themselves promiscuously.

Always leave your camp clean; others may have to occupy it after you, and they will suffer if you neglect this duty.

606. See that the cooking is carried out in as cleanly a manner as possible, and that food is protected from dirt and flies both before and after cooking.

607. Inspect the feet of your men regularly and see that they do not neglect the smallest break in the skin.

608. See that your men get every opportunity of washing or dry-cleaning their clothes.

609. Rest your men as much as possible. At halts, let them sit or lie down.

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Watch your men, and see that every man that falls out often on the march, or any man noticed in camp going to the latrine oftener than usual, is made to report himself sick at once. The serious diseases of camp life may often begin with diarrhea, and this should, therefore, be looked on as a danger signal. It may mean nothing, but it should never be overlooked.

610. *Clothing* is intended to protect from heat, cold, and damp. See that your men use it accordingly. Warn them especially against neglecting to change wet clothing when they can do so.

611. Keep garbage receptacles about your kitchen always covered. Or, better still, build an incinerator for the destruction of kitchen waste if fuel is available. Remember that the smallest particle of organic matter left exposed will draw flies, and an undue number of flies is a reflection on the company officers.

PREVENTION OF CHILLED FEET AND FROSTBITE.

612. These conditioons are caused by—

(*a*) Prolonged standing in cold water and mud.

(*b*) The continued wearing of wet socks, shoes, and leggins.

They are brought on much more rapidly when the circulation of the blood in the feet and legs is interfered with by the wearing of tight shoes, tight leggings, or the wearing of anything causing constriction of the lower limbs.

613. They can be prevented or diminished by—

(*a*) Improvements to trenches leading to dry standing and warmth.

(*b*) By reducing the time spent in the trenches as far as the military situation permits.

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(*c*) By regimental arrangements insuring that, so far as is possible, men enter the trenches warmly clad in dry socks, shoes, trousers, and leggins, and with the skin well rubbed with whale oil or antifrostbite grease.

(*d*) By the provision of warm food in the trenches when possible.

(*e*) By movement when possible so as to maintain the circulation of the blood.

(*f*) By the provision of warmth, shelter, hot food, and facilities for washing the feet and drying wet clothes for men leaving the trenches.

614. In order to minimize the prevalence of chilled feet and frostbite, commanding officers are responsible that the following instructions are carried out unremittingly and under the strictest supervision:

(*a*) Before entering the trenches feet and legs will be washed and dried, then well rubbed with whale oil or antifrostbite grease, and dry socks put on. It is of the utmost importance that whale oil or antifrostbite grease should not be merely applied, *but thoroughly rubbed in until the skin is dry.* Unless this precaution is systematically carried out the oil and grease become in a great measure valueless.

(*b*) A second pair of dry socks will be carried by each man and when possible regimental arrangements will be made for socks to be dried and reissued during each tour of duty in the trenches.

(*c*) While in the trenches shoes and socks will be taken off from time to time if circumstances permit, the feet dried, well rubbed and dry socks put on.

(*d*) On no account will hot water be used or the feet held near a fire.

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(*e*) Where possible, hot food will be provided during tours of duty in the trenches.

(*f*) When available, rubber boots will be put on before entering wet trenches.

(*g*) When rubber boots are worn the socks should be supported by some form of fastening such as a safety pin. On no account will anything in the form of a garter be worn. This would interfere with the circulation.

(*h*) When conditions are favorable regimental aid stations will be established in proximity to the trenches, where men who show signs of suffering from exposure can be promptly attended to.

615. Under brigade arrangement provision will be made for the washing and drying of feet in reserve billets, for the exchanging of wet socks for dry ones, and if possible the sending of the latter to trenches, and for drying and brushing clothes. Men will be required to make use of these arrangements.

616. Rubber boots will be issued when possible to all men holding water-logged trenches. The distribution of these boots depends upon the necessity for their use, according to the nature of the trenches held. Therefore, the distribution will be made not according to numerical strength of formations, but according to the nature of trenches units are required to hold. They are solely for the men in the trenches and will not be used under other conditions.

VETERINARY SERVICE.

617. Veterinarians are assigned to certain units. In many cases, however, veterinary advice is not available, and the fol-

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lowing list of common ailments and injuries with symptoms and treatment will be found useful:

Ailment or injury.	Symptoms, treatment, etc.
1. Abrasions; bruises...	Treatment: White lotion, 1 ounce each sugar of lead and sulphate of zinc to 1 quart of water. Caution: Do not mistake a soft puffy swelling near joints and tendons or on the abdomen for abscesses. Treatment for true pus abscess: Poultice (if not open), cut through skin with knife, then insert blunt instrument to pus cavity, flush twice daily, provide for drainage. Inject 5 per cent salt solution.
2. Bit injuries.....	Treatment: Rest mouth, work in snaffle; improvise martingale, if necessary. Wrap bit with 1-inch bandage at point of contact. Apply white lotion or 5 per cent alum.
3. Blind staggers.....	Treatment: Throw cold water on animal's head, remove collar, give an active physic. Place animal in a cool, dark, well ventilated stable. Keep him quiet and give cooling diet. Call veterinarian.
4. Broken knees.....	Treatment: Wash clean. Apply loose cotton and bandage or wash with 5 per cent salt solution and bandage.
5. Bruises.....	(See 1.)
6. Bullet or shell wounds.	Treatment: Of lower legs—Check bleeding by compression or packing and bandage. Later apply 5 per cent salt-water solution by injection or bathing. Of upper-leg regions and body—Stop bleeding by packing with cotton, gauze, or oakum, or take up bleeding vessel with forceps, tie with thread. Sewing up wound not necessary first few days, but keep clean and stimulate flow of blood with salt solution (5 per cent). Cleanse parts of hair, dirt, pieces of flesh, and all foreign matter. Improvised forceps for this purpose can be made with 2 flat splinters of wood (disinfected) tied at one end.
7. Catarrh.....	(See 11.)
8. Colds.....	Do.
9. Colic.....	Symptoms: Horse looks round at his sides, tries to lie down and roll, paws, stamps with hind legs, and kicks at belly. Treatment: Walk about, give chloral hydrate ball if available, or 2 ounces turpentine, well shaken up, either with a pint of linseed oil. If not relieved in an hour repeat the dose and give in addition an aloes ball, or Cannabis indica 2 to 4 drams, aromatic spirits of ammonia 1 ounce, water to make 1 pint; or fluid extract of belladonna 2 drams, nitrous ether 2 ounces, water to make 1 pint. In the absence of drugs give half tumbler of rum or whisky in a pint of warm water, or hot ginger or pepper tea. Hand rub belly and give frequent enemas of soapy water. (See "Sand colic.")

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Ailment or injury.	Symptoms, treatment, etc.
10. Constipation.....	Treatment: Soft food and green also, if available; regular work and frequent enemas. Withhold alfalfa hay; dampen clover or timothy hay, bran mashes, pasture, cold-water enemas, linseed oil, 1 pint, night and morning.
11. Coughs, colds, nasal catarrh.	Any animal with a nasal discharge should be isolated, and veterinary aid obtained as soon as possible. Treatment: Steam head with 2 ounces creolin in one-half bucket water, and apply liniment or mustard mixed, as for the table, to throat from ear to ear, and leave on for 15 minutes. Give soft food. Keep body warm with blankets and bandages, and give plenty of fresh air.
12. Cracked heels and mud fever.	Prevention: Do not wash legs when muddy, but leave until dry, and then brush dirt out. Treatment: Cleanse and dry (if greasy, apply dry bran poultice), dust on boric acid or powdered starch. Stand in dry place.
13. Cuts and tears.....	Treatment as for 12 and 30.
14. Diarrhea.....	Treatment: Examine feed for molds. Dry food; remove salt, restrict water. Clean out bowels; 1 pint linseed oil night and morning. Give 1-ounce dose white lotion 3 times a day.
15. Dirty sheath.....	Draw out penis and wash it and sheath with soap and warm water. Attendant should clean and trim his own nails before the operation.
16. Exhaustion after hard work.	Treatment: Complete rest, dry standing, blanket and leg bandage. Stimulate with whisky or aromatic spirits of ammonia, 2 ounces of each in ½ pint cold water. Bran mashes, steamed oats, oatmeal gruel. Strychnine, 1 grain in 2 ounces aromatic spirits of ammonia three times a day. Place in paddock.
17. Epizootic lymphangitis.	Symptoms: Sores similar to and in similar situations to farcy. They have a greater tendency to heal. Usually originates from a wound, from which point cordlike swellings appear and on the course of which these sores form. Treatment: Isolate. Very contagious. Proceed as for farcy. Call for services of veterinarian.
18. Farcy.....	Symptoms: Skin form of glanders. Appears as a string of running sores, usually on inside of hind legs, occasionally neck and face. No tendency to heal. Treatment: As for glanders. Be careful to distinguish from epizootic lymphangitis. Seek veterinary aid at once.
19. Fever, pneumonia..	Symptoms: Horse off feed, dull, temperature over 100° F. Treatment: Isolate and apply for veterinary aid. Give soft food and green stuff when available. Keep water always by and change frequently. Blister chest walls with thin mustard paste and cover up. If procurable, give a handful of epsom salts in each bucket of water. Keep body warm with blankets and bandages and give plenty of fresh air.

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Ailment or injury.	Symptoms, treatment, etc.
20. Girth galls.....	Treatment: If simply a swelling, lightly smooth over the swollen surface with the hand in the direction of the hair, as if to smooth it out, for 15 minutes at a time, supply white lotion. If skin is chafed, treat as for wounds. To work horse strap girth back, tying it under the belly to surcingle, which should be placed over fans of saddle. When healed, place piece of sheepskin under girth.
21. Glanders.....	Symptoms: Thick, gluey discharge from one or both nostrils, ulcers on the membrane, inside nostrils, glands between lower jaws enlarged, tender and hard. Treatment: Very contagious. *Rigid isolation* of affected cases, in contacts and whole unit, if possible. On suspicion, immediately obtain veterinary aid. If undoubted "glanders" animal should be shot. Very contagious to man, and fatal.
22. Grease heel.....	(See "Scratches.")
23. Heat stroke.....	(See "Sunstroke.")
24. Influenza.....	Symptoms: Same as in fever; also animal holds head low, staggers when walking, visible mucous membrane of yellowish tinge. When digestive organs affected, constipation the rule at first. Eyelids swollen, hot and sensitive to touch. Treatment: Isolate, as very contagious. Give quinine sulphate, 1 dram, gentian 2 drams, in ball, three times a day; add ½ ounce saltpeter to drinking water twice daily. Fever may be reduced by rectal injections of cool water. Intestinal troubles may be relieved by giving bicarbonate of soda in one dram doses three times a day. Bathe eyes in warm water, anoint with cosmoline.
25. Lymphangitis.....	(See 17.)
26. Mange.....	Symptoms: Marked skin irritation. Horse bites and rubs himself against any available object. Hair comes off in patches and skin becomes thickened and corrugated. Treatment: Isolate. Clip, burn clippings, dress with warm 5/100 creolin solution one-third surface of body daily, milder solution may be used all over. Thoroughly disinfect all stables, harness, utensils. Discontinue clothing. Exercise to sweating daily, if possible, and apply warm solution immediately on return. Seek veterinary aid. Suspect rash on man in contact with affected animals; treat man by frequent applications 2/100 creolin solution.
27. Mud fever.....	(See 12.)
28. Pneumonia.....	(See 19.)

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Ailment or injury.	Symptoms, treatment, etc.
29. Ringworm.....	Symptoms: Hair falls out in circular patches. Treatment: Wash region affected with common laundry soap and water, then apply creolin 2 parts, water 100 parts; or paint patches with tincture iodine or 1/000 bichloride of mercury, alcohol or water solution. Disinfect harness, brushes, curry combs, rubbing posts, picket lines with strong soap solution, then 5/100 creolin solution.
30. Rope, harness, or saddle galls.	Prevention: Head rope short. Care in fitting saddlery use pads where irritation exists; keep pads washed clean. Keep saddle off while healing. Treatment: Grease when marching; protect if possible, with light bandage; on return to camp wash with soap and water; dry and apply bran poultice. Apply methyline blue.
31. Saddle galls.....	(See 34.)
32. Sand colic.....	Prevention: Feed off blankets, etc. Clean food. Treatment: Give chloral hydrate balls and linseed oil in quart doses.
33. Scratches; grease heel.	Both due to uncleanliness as a rule. Scratches run into grease if not attended to. Treatment for scratches: Cleanse with castile soap and water; dry and apply sulphate zinc 1 ounce, acetate of lead 1 ounce, water 1 quart, or oxide of zinc 1 part, lanolin 10 parts. In bad case of grease, proud flesh must be cut and burned, better call the veterinarian. Marked skin irritation of heels, tenderness, lame at first. May follow "mud fever" in wet seasons and usually due to neglect. To treat scratches always use cotton and bandage drawn lightly. Don't use water but clean dry and dust with boric acid, starch or apply white lotion or zinc ointment; use cotton and bandage. Grease heel requires hospital and veterinary aid.
34. Sore backs and saddle galls.	Prevention: Careful supervision and fitting of saddlery. Treatment: If swelling only, treat as for (20) or bathe with cold salt water. Apply white lotion. If skin chafed, treat as for wounds. Keep saddle off back until healed. Apply methyline blue.
35. Sore withers.....	Treatment: Keep arch of saddle well clear of withers. If swelling, only bathe with cold salt water. If skin broken, treat as for wounds.
36. Sprained tendons, or joints, etc.	Treatment: Rest, examine foot for possible injury. For sprain apply wet cotton pad and bandage lightly; keep wet or use white lotion; i. e., lead acetate 1 ounce, zinc sulphate 1 ounce, water 1 quart; apply direct and cover with wet bandage. In absence of medicines, etc., use cold salt water or clay poultice.

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Ailment or injury.	Symptoms, treatment, etc.
37. Strangles	Symptoms: High fever and nasal discharge. Swelling at the back of or under the jaw. May be some difficulty in swallowing. Treatment: Isolate and obtain veterinary aid. Rest, soft food, blanket and bandage: plenty of fresh air and foment swelling. I ance swelling, or if it bursts treat as for wounds. Give ½ ounce saltpeter in drinking water.
38. Sunstroke or heat-stroke.	Reduce temperature by cold water or ice on head and cold water injections. Give 2 ounces aromatic spirits of ammonia or 4 ounces alcohol in 8 ounces (1 pint) of water. Repeat dose in 1 hour if necessary.
39. Thrush	Treatment: Clean frog, dress cleft with boric acid or salt, and then plug with piece of tow. If severe, poultice or soak foot before applying dressing. Powdered calomel sprinkled over diseased part will dry up thrush in 2 or 3 days. Keep foot dry for several hours after administering. Stand on driest ground available. Open heels with knife.
40. Ticks, lice	Treatment: Pull out only when dead; apply strong decoction tobacco in saturated (all water will dissolve) solution of salt. Soak affected parts every other day. Look out for lice; nits readily seen fastened to hair; hatch in 7 to 10 days. Coal oil, alcohol, turpentine very useful.
41. Wounds	(See 6.)

NOTES.

To make—

(*a*) *Bran mash.*—Put two double handfuls of bran in a bucket and pour on as much boiling water as the bran will soak up. Cover bucket with blanket and leave until cool enough to eat. Teaspoonful of salt improves.

(*b*) *Steamed oats.*—Substitute oats for bran and proceed as above.

(*c*) *Gruel.*—Cook oatmeal as for porridge and thin down with water, or may mix oatmeal with water right away.

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To shoot a horse, lift up forelock and place it under brow band. Place muzzle of revolver almost touching the skin where the lowest hairs of the forelock grow.

The mallein test should be given at prescribed intervals or when glanders is suspected in stable or on picket line.

For list of veterinary supplies, instruments, medicines, field equipment, etc., see G. O. 115, W. D., 1911.

Solutions:

(*a*) Salt solution, normal, 0.6 of 1 per cent; for injection in wounds and bathing, 5 per cent.

(*b*) Drying solution and astringent, white lotion.

(*c*) Antiseptic. 1 per cent tincture of iodine in water, 1 per cent creolin in water.

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CHAPTER VIII.

CORRESPONDENCE.

618. The following examples will be used as guides in carrying on correspondence in the Army:

FORT SHERIDAN, ILL.,
October , 19

From: The Ordnance Officer.
To: The Commanding Officer, Cav.
Subject: New system of issuing ordnance stores.

1. In compliance with instructions contained in a letter from The Adjutant General's Office, dated , regarding the testing of a new system of issuing ordnance stores, the following report concerning the working of this system is submitted.

2. As far as I have been able to observe, the new system has no disadvantages. Its advantages are:

* * * * *

A——— B———,
1st Lt. Cav.

1st Ind.

Hq. Cav., Fort Sheridan, Ill., Oct. , 19 —To the C. O., Fort Sheridan, Ill.

I concur in the conclusions of the Ordnance Officer.

C——— D———,
Col. Cav., Comdg.

2d Ind.

Hq. Ft. Sheridan, Ill., Nov. , 19 —To Comdg. Gen., Central Dept.

Approved.

E——— F———,
Comdg.

(Stamp) To Chief Ordnance Officer.

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3d Ind.

Hq. Central Dept., Nov. , 19 —To The Adjt. Gen. of the Army.
Approved.

G——— H———,
Maj. Gen., Comdg.

4th Ind.

A. G. O., Nov. , 19 —To the C. of O.
36949–204 5th Ind. Ghs-Bam
Office of the C. of O., Nov. , 19 —To Comdg. Officer, Rock Island Arsenal.
For remark with reference to paragraph 2 of the within letter. By order of the Chief of Ordnance.

I——— J———,
Capt. Ord. Dept.

159–181
36949–204 6th Ind. Hf-L
Rock Island Arsenal, Ill., Nov. , 19 —To the Chief of Ordnance.
1. It is the practice at this arsenal to make shipments of all articles required on * * *
2. The final shipment in this particular case was delayed by the failure of ——— ——— to supply acceptable * * *

K——— L———,
Lt. Col. Ord. Dept. Comdg.

(Stamp) Rec'd back, O. C. of O., Nov. , 19 .

36949–204 7th Ind. JMy
Office of the C. of O., Nov. , 19 —To The Adjt. Gen. of the Army.
Returned in connection with O. O. file 36949–198 (A. G. O. 1527570).

M——— N———,
Lt. Col. Ord. Dept., Actg. C. of O.

(Stamp) Rec'd back, A. G. O., Nov. , 19 .

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1527570 8th Ind.
War Department, A. G. O., Nov. , 1900 —To Comdg. Gen., Central Dept., Comdg. Gen., Eastern Dept., etc. * * *
Returned in connection with papers referred to in the preceding indorsement hereon. The early return of all papers is desired. By order of the Secretary of War.

O——— P———,
Adjutant General.

9th Ind.
Hq. Central Dept., Nov. , 191 —To Comdg. Gen., Eastern Dept.
Noted.

R——— S———,
Maj. Gen., Comdg.

(Stamped indorsement.)

10th Ind.
A. G. O. D. D.
Nov. , 19
To the Chief Ordnance Officer.

619. The body of the letter will be followed by the signature. If the rank and the regiment, corps, or department of the writer appear at the beginning of the letter, they will not appear after his name; but if they do not appear at the beginning of the letter, they will follow under his name.

620. Only one side of the paper will be used, the writing beginning about 1 inch from the top.

621. The stamps bearing office numbers will be placed on the back of the lower fold of the first sheet. The received and received-back stamps will be placed immediately below the body of the letter, and, in the case of indorsements, immediately after the proper indorsement. When a communication of two or more sheets is filed, the back of the lower fold of the first sheet will be on the outside, thus exposing to view the office numbers.

622. The lines beginning From: To: Subject: in the sample letter constitute the brief of the communication.

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623. Letter paper will be folded in three, and foolscap in four, equal folds, parallel with the writing; the top fold will be folded toward the back of the letter and the lower fold over the face of the letter. In three-fold letters both the brief and the office mark will be on the outside. In three-fold letters of more than one sheet the two lower folds of the sheets other than the first will be placed between the first and second folds of the first sheet, thus exposing to view both the brief and the office mark. In four-fold letters, whether of one or more sheets, the briefs will be exposed to view by covering the office mark fold, or the office mark be exposed to view by covering the brief, according as it is desired to keep either the one or the other exposed to view for the purpose in hand.

624. Inclosures will be numbered, given office mark, and noted on face of letter to left of signature. Inclosures to indorsements will be noted at foot of indorsement to which they belong. Total number of inclosures will be noted at foot of each indorsement thereon. Routine indorsements will not be signed but will be initialed.

625. Officers who fail to make prompt reply to official communications without satisfactory explanation will be subjected to disciplinary measures.

When in order to make proper reply it is necessary to examine papers not at hand, or when for other sufficient reason full and prompt reply is impossible, acknowledgment of the receipt of the communication will be made at once, with a statement giving the cause of the anticipated delay.

626. All communications, except to The Adjutant General of the Army, will be addressed to the commanding officer concerned.

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MAILING OF LETTERS OF SOLDIERS IN THE FIELD.

627. Letters sent by soldiers, sailors, and marines in the United States service, located in the United States or any of its possessions, or other places where the United States domestic mail service is in operation, addressed to places in the United States or any of its possessions, when indorsed "Soldier's letter," "Sailor's letter," or "Marine's letter" and signed thereunder, either with facsimile hand stamp or in writing, with his official designation, by a field or staff officer, post or detachment officer to whose command the soldier belongs * * * may be dispatched to destination without prepayment of postage, and only the single rate of postage shall be collected on delivery.

WAR DIARIES.

(Par. 35, F. S. R.)

628. These are confidential. Their purposes are:

(*a*) To furnish an accurate record of operations from which the history of the war can subsequently be prepared.

(*b*) To form the basis for improvements in organization, education, training, equipment, supply, and administration of the Army for war.

629. Duplicating books of war diary sheets are issued. Each contains 30 sheets No. 1 and 60 sheets No. 2. The pages of the sheets are shown on pages following:

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[Page 1, sheet No. 1.]

War diary of..... (see par. 35, F. S. R.) Date, ...

Sheet No. 1. (Write and paste nothing in this margin.)

March table.

Organization.	From—	Hour	To—	Hour	Dist.

Remarks: .....

State of supply 11.59 p. m.

In combat train .....

In amm. train .....

With troops: Rations ..... Forage .....

In supply train: Rations ..... Forage .....

Available for all duty: Officers ..... Men .....

Weather .....

Roads .....

Health .....

Camp .....

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[Page 2, sheet No. 1.]

Hour	Appendix No.	Chronological record of events	Captures	Losses								Officers	Men	Horses	Mules	Waggons	Guns	Caissons
		NOTE.—If moving, show place opposite hour.																

(Write and paste nothing in this margin.)

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[Page 1, sheet No. 2.]

SHEET NO. 2.

War diary.

(Write and paste nothing in this margin.)

Hour	Appendix No.	Chronological record of events	Organization, ... Date, ...
		NOTE.—If moving, show place opposite hour.	

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[Page 2, sheet No. 2.]

Hour	Appendix No.	Chronological record of events

(Write and paste nothing in this margin.)

630. Diaries are kept on improvised forms if the printed sheets are not available (A. R. 446).

631. The attestation appears on the line next below the last entry for the day.

TELEGRAPH CODE BOOKS AND CIPHERS.

[Part XVI, S. B., 1916.]

632. The War Department telegraph code is a collection of arbitrary words or groups of letters to each of which is assigned some ordinary word, proper name, phrase, or sentence as a meaning. It is adapted to special military needs in peace or war. Each word contains but five letters.

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633. When code books are used for economy the words or phrases of the message are coded by direct reference to their respective code equivalents. The message is said to be in plain code. It is readily translated by reference to a code book. When secrecy is desired, some method of enciphering is employed to prevent translation without the use of a key.

634. Ciphers embrace all means whereby writing may be transcribed in occult terms. Some distinct method of transcription is always employed. This method is called a key. It is usually applied directly in enciphering and reversed in deciphering messages.

635. A military cipher should fulfill the following requirements:

(*a*) It should be materially indecipherable, i. e., it should necessitate considerable trouble and delay in deciphering without the key.

(*b*) Written notes should not be necessary for its use.

(*c*) The key must be necessary for deciphering, even though the apparatus and the method come into the possession of the enemy.

(*d*) The key should be easy to spell and to remember and contain as many different letters as possible.

(*e*) The system should be applicable to telegraphic use.

(*f*) The method of enciphering and deciphering should be simple.

(*g*) The apparatus should be easy to carry and operable by a single person.

636. The following instructions govern the enciphering and deciphering of messages:

(*a*) No message should contain paragraphs partly in clear and partly in cipher.

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(*b*) Ciphers or deciphers must not be written on the same sheet as the original message.

(*c*) Each cipher message must be checked before dispatch.

(*d*) Reference to cipher messages should be avoided in clear correspondence.

(*e*) Cipher messages should be arranged in groups of five letters.

(*f*) Enciphering and deciphering should be mechanically performed; there should be no attempt to guess.

(*g*) All papers used in enciphering or deciphering must be destroyed. If records are essential, the original should be paraphrased unless the exact wording of a particular part is specially important.

THE CIPHER DISK.

637. This is a simple device composed of a circle of cardboard, celluloid, or other material revolving upon a card. The alphabet, reading from left to right, is printed on the card in upper-case letters. Reading from right to left it is printed on the circle in lower-case letters.

638. If it is desired to encipher a message, the key letter or the first letter of the key word or words is set opposite "a." Let us assume it to be "E." The cipher letters to be written are those opposite the text letter when the letter "a" on the circle is set opposite "E" on the card. For example "Send powder" would be written "marb pqiban." Numbers when enciphered with the cipher disk must be spelled out.

639. Having a cipher disk as above described, this mere transposition of letters would delay but a short time the deciphering of a message by one not knowing the key letter, as it would be necessary only to place, in turn, opposite "a," each of the letters of the alphabet beginning with "B," and noting

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the letters opposite the enciphered letters. But this simple disk can be used with a cipher word, or, preferably, cipher words, known only to the correspondents, and it is entirely improbable that a message so enciphered could be deciphered in time to be of any value to the enemy. Using the key words "permanent body" to encipher the message "Reenforcements will reach you at daylight," we would proceed as follows: Write out the message to be enciphered and above it write the key word or key words, letter over letter, thus:

PERMANENTBODYPERMANENTBODYPERMANENTB
Reenforcementswillreachyouatdaylight
yanzvznlppkqfxijbpwanruqpeplomccwhmi

640. Now bring the "a" of the circle under the first letter of the key word on the card, in this case "P." The first letter of the message to be enciphered is "R"; "y" is found to be the letter connected with "R," and it is put down as the first cipher letter. The letter "a" is then brought under "E," which is the second letter of the key word. "E" is to be enciphered and "a" is found to be the second cipher letter. Then bring "a" to "R" and the cipher letter "n" will represent "E," the third text letter of the message. Proceed in this manner until the last letter of the cipher words is used, and beginning again with the letter "P" so continue until all letters of the message have been enciphered. Divided into groups of five letters it will be as follows: "yanzv znlpp kqfxi jbpwa nruqp eplom ccwhm i."

EMPLOYMENT OF CIPHER DISK.

641. If messages are enciphered by a mere transposition of the letters of the alphabet, the cipher disk can be used to quickly decipher the message, as the following example will show:

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Assume that "a" is used to represent "F," "b" to represent "E," "c" to represent "D," "d" to represent "C," "e" to represent "B," etc., in regular sequence, and that the message to be enciphered is, "We are short of rifle ammunition; send 20,000 rounds at once."

642. This would be enciphered, if divided into groups of five letters, as follows: "jbfob nyrom raoxa ubftt lsxmx rsnbs cmjbs mhmyr lnfsc orlsc nfmrs db."

643. Place "a" of the circle opposite "B" of the card and notice whether the cipher letters "jbfob"—the first group—are intelligible. They give "SAWNA"; continue this, for "SAW," the first three letters, may be the text word. Now, the next group is "nyrom," and these give "ODKNP." We know that "a" does not represent "B" because the first 10 cipher letters give the meaningless letters "SAWNAODKNP." Turn "a" to "C" and we have the first group "TBXOB," which is without meaning. Turning "a" to "D" we get "UCYPC," a meaningless jumble. Turn "a" to "E" and we get "VDZQD," which is meaningless. Now turn "a" to "F" and we find that "jbfob" means "WEARE," which gives us the two words "We are." We continue to the next group "nyrom," which gives us "SHORT." We now have these letters "WEARE SHORT," which at a glance we read "We are short." It would appear that we have now found the key letter, and after deciphering several additional groups we are confirmed in this belief and the information hidden in the cipher is ours. Continue deciphering with "a" opposite "F" until the end of the message. Sometimes the key letter is changed after two, three, or four letters. It is a matter of minutes only to run through the alphabet and learn the meaning of a message so enciphered.

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IMPROVISED SUBSTITUTE FOR CIPHER DISK.

644. Cut vertical strips, each about one-half inch wide, from lined writing paper. Paste these end to end so that two strips will be made up, one with 26 spaces and the other with 52 spaces. Write the alphabet twice beginning with letter "A," down the 52-spaced strip, and write it once backwards, beginning with the letter "Z," down the 26-spaced strip. These two strips, when laid side by side, may then, by sliding the 26-spaced strip up and down to the appropriate letter on the 52-spaced strip, be made to perform the functions of a cipher disk. Strips cut from blanks of the field message book and pasted end to end will serve conveniently for improvising this substitute, the letters being written in the small squares on the backs of the strips.

THE ROUTE CIPHER.

645. This is a cipher in which the words of a message are retained unchanged, but are so disarranged by preconcerted rules that the sense becomes unintelligible. The message as received seems to be a number of disconnected words without meaning, but by arrangement in proper order in accordance with certain rules can be easily read. Messages enciphered in this manner may be translated by persons not in possession of the key, and therefore the information contained therein should only be of such a character as to be of little value to the enemy unless acted upon immediately. The usual method employed in arranging a message for this cipher is to write the words in vertical columns. The number of words in each column should always equal the number of columns, being made so, if necessary, by the addition of sufficient "blind" words. A preconcerted route is agreed upon, as up the first column, down the

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third, up the second, etc. The message is then transmitted without reference to the columns, but is deciphered at the receiving station by column arrangement and perusal along the original route.

646. For example, to encipher the message "Move daylight. Enemy approaching from north. Prisoners say strength one hundred thousand. Meet him as planned," arrange as follows:

Move	strength	planned	say
daylight	one	as	prisoners
enemy	hundred	him	north
approaching	thousand	meet	from

647. Here the route is down the first column, up the fourth, down the second, and up the third.

THE SOLUTION OF CIPHERS.

648. Probably no enciphered message is absolutely unreadable. The resort to ciphers common in war makes the services of cipher experts necessary. A suitable work for study of the subject is, Manual for the Solution of Military Ciphers, by Capt. Parker Hitt, Infantry, published by the Army Service Schools, 1916.

649. For the solution of cryptograms a knowledge of the frequency of recurrence of letters of the alphabet is very important. The following table showing frequency in a count of 1,000 letters of military orders and reports is applicable to the solution of military cryptograms.

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Letter.	English.	German.	Spanish.	French.	Italian.	Portuguese.
A	78	52	135	80	117	140
B	14	18	11	6	6	6
C	30	31	48	33	45	34
D	40	51	53	40	31	40
E	127	173	140	197	[1]126	142
F	20	21	9	9	10	12
G	17	42	14	7	17	10
H	60	41	10	6	6	10
I	67	81	61	5	114	59
J	5	1	4	3	[2]	5
K	7	10	.....	.....	[3]	.....
L	37	28	52	49	72	32
M	29	20	30	31	30	46
N	69	120	62	79	66	48
O	80	28	82	57	93	110
P	22	8	26	32	30	28
Q	1	[4]	9	12	3	16
R	65	69	75	74	64	64
S	62	57	73	66	49	88
T	85	60	42	65	[1]60	43
U	31	51	39	62	29	46
V	11	9	9	21	20	15
W	18	15	.....	[4]	.....	.....
X	3	[4]	1	3	[3]	1
Y	20	[4]	10	2	[3]	0.6
Z	2	14	4	1	12	4

[1] Variable through interchangeability.
[2] Substitute for double "I."
[3] "K" equals "C" or "CH"; "X" equals "S" or "SS"; "Y" equals "I."
[4] Occasional, usually in proper names.

DISCIPLINE.

650. To invoke court-martial jurisdiction rather than exercise power of command in matters to which the latter is applicable and effective is to choose the wrong instrument, disturb unnecessarily military functions, injure rather than maintain discipline, and fail to exercise an authority the use of which develops and increases capacity for command.

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651. The commanding officer of any detachment, company, or higher command may for minor offenses not denied by the accused impose disciplinary punishments upon persons of his command without the intervention of a court-martial, unless the accused demands trial. Such disciplinary punishment may include admonition, reprimand, withholding of privileges, extra fatigue and confinement to specified limits, but shall not include forfeiture of pay or confinement under guard. The right to demand a trial must be made known to the accused before the award of punishment. After the award the accused may appeal through proper channels to the next higher authority if he deems his punishment unjust or disproportionate to the offense.

652. The following punishments are prohibited:

By law: (*a*) Flogging; (*b*) branding, marking, or tattooing on the body.

By custom and regulations: (*c*) Carrying a loaded knapsack; (*d*) wearing irons as a punishment; (*e*) shaving the head; (*f*) placarding; (*g*) pillory and stocks; (*h*) tying up by thumbs.

653. The imposition of military duty, such as guard tours as a punishment, is prejudicial to the best interests of the service.

654. Solitary confinement on a bread-and-water diet and the placing of a prisoner in irons (except for the purpose of preventing escape) are means of enforcing prison discipline and will not be imposed as a punishment.

COURTS-MARTIAL.

(Manual for Courts-Martial, 1917.)

655. Competent to serve, all commissioned officers in the service of the United States and officers of the Marine Corps detached for service with the Army by order of the President.

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The accuser or a witness for the prosecution is ineligible except that when there is but one officer present with a command he shall be its summary court.

656. Chaplains, veterinarians, dental surgeons, and second lieutenants in the Quartermaster Corps are not in practice detailed as members of courts-martial.

657. Number of members: General courts-martial, 5 to 13; special courts-martial, 3 to 5; summary courts-martial, 1.

658. Jurisdiction of—

General courts-martials:

(*a*) Any person subject to military law, for

(*b*) Any crime or offense punishable under the Articles of War, and, in addition,

(*c*) Any person other than the above, who by the law of war is subject to trial by military tribunals, for

(*d*) Any crime or offense in violation of the law of war.

Special courts-martial:

(*a*) Any person subject to military law, except—

(1) An officer.

(2) Any person subject to military law belonging to a class or classes[1] excepted by the President for

(*b*) Any crime or offense (not capital[2]) punishable under the Articles of War.

Summary courts-martial:

(*a*) Any person subject to military law, except—

(1) As for special courts-martial.

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[1] Cadets and soldiers holding certificates of eligibility for promotion.

[2] Peace: Assaulting or disobeying a superior officer; mutiny or sedition; failure to suppress mutiny or sedition.

War: Desertion; advising or aiding another to desert; misbehavior before the enemy; subordinates compelling commander to surrender; improper use of countersign; forcing a safeguard; relieving, corresponding with, or aiding the enemy; spies; misbehavior of sentinel.

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(2) A noncommissioned officer who objects thereto, unless his trial is ordered by an officer competent to bring him to trial before a general court-martial.

(*b*) Any crime or offense (not capital) punishable under the Articles of War.

659. Limits of punishment:

General courts-martial, discretionary except—

(*a*) When mandatory under the law, or

(*b*) When limited by the President under A. W. 45, and

(*c*) The death penalty can be imposed only when specifically authorized.[1]

Special courts-martial[2] can not adjudge—

(*a*) Dishonorable discharge, or

(*b*) Confinement exceeding six months, or

(*c*) Forfeiture exceeding six months' pay.

660. Summary courts-martial[3] can not adjudge—

(*a*) Dishonorable discharge, or

(*b*) Confinement exceeding three[4] months, or

(*c*) Forfeiture exceeding three months'[4] pay.

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[1] Death penalty mandatory in case of spies; dismissal for conduct unbecoming an officer and gentleman; death or imprisonment for life for murder and rape. Punishment mandatory in part and discretionary in part for false muster, false returns, officer drunk on duty in time of war, and personal interest in sale of provisions.

[2] Reduction of noncommissioned officers to the ranks and of first-class privates in classification are within the powers of special and summary courts-martial.

[3] Reduction of noncomsissioned officers to the ranks and of first-class privates in classification are within the powers of special and summary courts-martial.

[4] One month if summary court-martial is the commanding officer, unless greater punishment is approved by superior authority.

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661. The following are authorized to appoint—

General courts-martial:[1]

(*a*) The President.

(*b*) The commanding officer of a territorial division or department.

(*c*) The commanding officer of an army, army corps, division, or separate brigade.

(*d*) The commanding officer of any district or force or body of troops when empowered by the President to do so.

(*e*) The Superintendent of the Military Academy, except for the trial of an officer.

Special courts-martial:[1]

(*a*) The commanding officer of a district, garrison, fort, camp, or any other place where troops are on duty.

(*b*) The commanding officer of a brigade, regiment, detached battalion, or other detached command.

Summary courts-martial:

(*a*) The commanding officer of a garrison, fort, camp, or any other place where troops are on duty.

(*b*) The commanding officer of a regiment, detached battalion, detached company, or any other detachment.

(*c*) Any superior commander who deems it desirable.

OTHER MILITARY TRIBUNALS.

662. The jurisdiction conferred upon courts-martial does not deprive military commissions, provost courts, etc., of concurrent jurisdiction over persons and offenses that by the law of war may be lawfully tried by them.

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[1] Can not be appointed by the accuser or prosecutor of person or persons to be tried. In such cases court will be appointed by superior competent authority.

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MILITARY POLICE.

663. The function of the train and military police force is to guard trains and carry out the police service of the division or other force to which it is assigned, under the authority of the commander of the force to which attached.

664. It is their duty to maintain order and march discipline in the trains, both on the march and when under their charge in camp. On the march the train guard will attend to the security of the train, defend it in case of attack, prevent teamsters from cutting loose their teams or abandoning them, prevent interference by unauthorized persons. In camp it will carry out such instructions as the train commander or other proper authority shall indicate.

665. They will prevent all unlawful requisitioning and looting, and excesses of all kinds, keep roads clear so far as possible for the passage of persons and vehicles in the direction opposite to that in which the train is moving, arrest all persons found in their vicinity without authority, supervise camp followers, arrest marauders, collect stragglers and stray animals and dispose of them as orders may indicate. They also supervise railroad stations, saloons, restaurants, depots, public buildings, etc., keep hostile inhabitants in order, and prevent spying.

666. They will not interfere with properly formed bodies of troops, but will make any necessary reports of irregularities committed by them to their commanding officer.

667. All persons with the Army are bound to support the military police in the exercise of their office.

668. Only field officers or higher are authorized to reprimand any military police who are on duty and who neglect or exceed their duty. Proper report should be made to the commander of the police.

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GENERAL DUTIES WITH THE FORCES IN THE FIELD.

669. The military police are charged with—

(1) The detection of crime and the arrest of the offender.

(2) The maintenance of order under all circumstances within the area occupied by the formation to which they are attached.

(3) The surveillance and control of all civilians and followers attached to their formations, as well as vagabonds and persons suspected of espionage (in consultation with the intelligence branch).

(4) Assisting in maintaining the march discipline, discipline of troops and transport, and in regulating traffic generally.

(5) The collection of stragglers.

(6) The custody of prisoners of war until their transfer to the railhead.

(7) The protection of the inhabitants against acts of violence on the part of soldiers and followers.

POWERS.

670. The authority of the military police extends over all matters concerning crime and offenses committed within the area of the formation to which they are attached.

671. The military police are empowered to enter public or private houses and billets occupied by troops if they have reasonable grounds for suspecting that existing regulations are being disobeyed or that breaches of discipline are occurring. Military police should, if possible, be accompanied by civilian police when entering private houses. They may call on any troops to assist them by supplying guards, sentries, or patrols. *Failure to render such assistance when called upon is a military crime and to be reported at once.*

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672. In the exercise of their powers the military police must act with the judgment and foresight indispensable to the proper performance of their duties. They must assert their authority whenever necessary and must not hesitate to report infringements of or refusal to obey orders issued by them in the execution of their duties.

673. Resisting the military police is the same as resisting a sentinel.

674. While on duty military police should wear a brassard with M. P. When not on duty members of the military police have no more authority than other troops. Officers of the military police are always on duty.

SPECIAL DUTIES.

675. The duties of the military police are to patrol, police, and maintain order within the areas occupied by organizations to which they are attached.

676. They are to see that orders regarding the maintenance of discipline are enforced.

677. They will take measures to prevent troops getting into contact with undesirable characters, i. e., prostitutes, bootleggers, peddlers, etc.

678. They are responsible for the arrest of persons committing the following and such other offenses, not herein mentioned, as may be subversive of discipline:

(1) Breaking out of billets, camp, or quarters.

(2) Being found off limits.

(3) Drunkenness, whether on or off duty.

(4) Assisting persons subject to military law to desert, or of neglecting to assist in the apprehension of a deserter.

(5) Releasing or allowing to escape a prisoner taken into military custody.

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(6) Escaping or attempting to escape from arrest or confinement.

(7) Illtreating animals.

(8) Civilians or followers found within the lines without passes or identification disks.

(9) Plundering, marauding, or making unlawful requisitions.

(10) Neglecting to obey standing orders.

(11) Illtreating inhabitants.

(12) Soldiers or civilians selling rations or Government property of any description.

(13) Breaches of traffic regulations.

(14) Officers or men taking photographs or found in possession of cameras.

679. The military police will collect stray horses and take them to headquarters for return to their owners. Stray horses belonging to the enemy will be turned over to the proper military authorities.

680. They will arrest anyone giving military information to anyone with whom they are not personally acquainted or to anyone, even if an acquaintance, who is not a member of the military forces in the field.

681. They will arrest, pending inquiry, any individual whose movements appear to be suspicious, whether this individual is dressed as an officer, enlisted man, or civilian of any nationality.

682. All carrier pigeons found in confinement are to be seized unless the owner is provided with necessary authority for keeping them.

DUTIES IN BILLETS OR CAMPS.

683. When an organization is occupying an area the military police will furnish day and night patrols to police the area. These patrols will be accompanied by civilian police when necessary.

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684. The duties of these patrols are to enforce all orders relating to discipline, to close saloons, shops, etc., at the proper hour, conduct stragglers to their proper units, arrest suspects, prevent plundering and illtreatment of inhabitants.

685. When troops leave a camp or billet a sufficient number of military police will be left behind—

(*a*) To collect all ammunition or articles of equipment that may be left behind.

(*b*) To search cafés, saloons, etc., and collect all stragglers and generally satisfy themselves that camps and billets have been evacuated.

(*c*) To efface all chalk marks on billets (see "Billeting") and report organizations that have failed to comply with orders to this effect. This does not apply to any building that may have been labeled "Infected."

(*d*) To collect and hand over to the proper authorities all letters, etc., found.

ON THE MARCH.

686. During a march the military police will assist in seeing—

(1) That wagons keep well to the right, no more than two men, including the driver, on a wagon. Led animals should be led on their near side.

(2) Distances carefully kept.

(3) Stragglers carefully collected and brought along until they can be handed over to their units. If unable to walk, arrange for them to ride.

(4) That crossroads, road junctions, defiles, etc., are specially watched to prevent congestion. Traffic crossing a column will be stopped and allowed to pass as opportunity presents itself.

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Staff officers and dispatch riders should be passed with as little delay as possible.

(5) That no civilian wagons be allowed in the column.

(6) That no unauthorized civilians accompany the column.

(7) That civilians approaching from the rear are not allowed to go forward of the rear guard. Such as are overtaken are directed away from the column.

687. During a halt the military police will see—

(1) That side roads are not blocked, that bridges are clear, and that at crossroads a free passage is kept to enable traffic to pass through the column.

(2) That all wagons are drawn close to the right side of the road and that horses' heads are toward the center of the road.

(3) That the left side of the road is clear of drivers and men marching with the column.

DURING AN ENGAGEMENT.

688. The military police will—

(1) Maintain order in rear of the troops in action.

(2) Prevent congestion on roads leading to the front, particularly at road junctions, bridges, etc., collect stragglers and men wandering around without a satisfactory explanation.

(3) Direct wounded to dressing stations or stations for slightly wounded, if case warrants it.

(4) Ascertain the position of various units in the neighborhood, so as to be able to direct officers and orderlies.

(5) Patrol evacuated villages in rear of the firing line and arrest all pillagers.

(6) In case of retreat, they will clear the roads to facilitate the march of troops.

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689. All of the above more or less general duties will be supplemented by specific instructions, depending upon the locality in which the troops are operating, the nature of the operations, particular duties of the police, etc.

THE LAWS OF WAR.

690. The conduct of war on land and sea is regulated by certain well-established and recognized written and unwritten rules, which are usually designated as "the laws of war."

691. Since 1850, many of these rules have been reduced to writing by means of conventions and treaties, entered into by the principal civilized nations of the world, after full discussion, at Petrograd (St. Petersburg), Brussels, The Hague, and Geneva.

692. The more important of the written rules will be found in Appendix 6, F. S. R., 1914. A more complete list of the written rules and a thorough discussion of the unwritten customs and usages will be found in The Rules of Land Warfare, 1914.

693. The foregoing do not constitute a complete code as appears from the preamble of Convention IV of October 18, 1907, at The Hague:

According to the views of the high contracting parties, these provisions, the preparation of which has been inspired by the desire to diminish the evils of war, as far as military requirements permit, are intended to serve as a general rule of conduct for the belligerents in their mutual relations and in their relations with the inhabitants.

It has not, however, been found possible at present to prepare regulations covering all the circumstances which may arise in practice.

On the other hand, the high contracting parties clearly do not intend that unforeseen cases should, in the absence of written

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undertaking, be left to the arbitrary judgment of military commanders.

Until a more complete code of the laws of war has been formulated the high contracting parties deem it expedient to declare that, in cases not covered by the regulations adopted by them, the inhabitants and belligerents remain under the protection and the rule of the principles of the law of nations, as they result from the usages established among civilized peoples, from the laws of humanity, and the dictates of public conscience.

694. It will be noted that the conventions and treaties referred to above have been fully assented to by a number of nations. Others have agreed to the greater part of the provisions set forth but have made exceptions to some. (See pp. 184, 185, R. L. W., 1914.)

THE UNWRITTEN RULES.

695. In addition to the written rules there exist certain other well-recognized usages and customs that have become recognized. These rest on three basic principles:

(*a*) A belligerent is justified in applying any amount and any kind of force necessary to accomplish the submission of the enemy at the earliest possible moment with the least expenditure of time and money.

(*b*) The dictates of humanity require that all such kinds and degrees of violence as are not necessary shall be dispensed with.

(*c*) There should be a chivalry in war, and this demands that there should be fairness and mutual respect between the opposing forces in their relations with each other.

696. Military necessity admits of all direct destruction of life or limb of *armed* enemies, and of other persons whose destruction is incidentally *unavoidable* in the armed contests of

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war; it allows the capturing of every armed enemy, and of every enemy of importance to the hostile government, or of peculiar danger to the captor; it allows all destruction of property, and obstruction of ways and channels of traffic, travel, or communication, and all withholding of sustenance or means of life from the enemy; the appropriation of whatever the enemy's country affords that is necessary for the subsistence and safety of the army, and such deception as does not involve the breaking of good faith, either positively pledged, regarding agreements entered into during the war, or supposed by the modern law of war to exist.

697. Military necessity does not admit of cruelty—that is, the infliction of suffering for the sake of suffering or for revenge, nor of maiming or wounding except in fight, nor of torture to extort confessions. It does not admit of the use of poison in any way, nor of the wanton devastation of a district. It admits of deception, but disclaims acts of perfidy; and, in general, military necessity does not include any act of hostility which makes the return to peace unnecessarily difficult.

HOSTILITIES.

698. The first effect of war between two countries is to cause every subject of one to become an enemy of every subject of the other.

699. The enemy population is divided in war into two general classes, known as *the armed forces* and *the peaceful population.* Both classes have distinct rights, duties, and disabilities, and no person can belong to both classes at the same time.

700. The members of the army are entitled to recognition as belligerent forces whether they have joined voluntarily, or have been compelled to do so by State law, whether they joined

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before or after war is declared, and whether they are nationals of the enemy or of a neutral state.

701. *The first condition for militia and volunteer corps* is satisfied if commanded by a commissioned officer, or by a person of position and authority, or if the officers, noncommissioned officers, and men are furnished with certificates or badges, granted by the Government of the State, that will distinguish them from persons acting on their own responsibility.

702. The requirement as to distinctive sign or badge will be satisfied by wearing uniform. This must be as complete as possible and the forces must habitually bear their arms and other weapons openly. The latter condition is imposed to prevent bodies of men using arms for active opposition and then discarding or concealing them at their own convenience.

703. When such troops are utilized they must be instructed in and be required to conform to the laws of war, and especially as to certain essentials, such as the use of treachery, maltreatment of prisoners, the wounded and dead, violations of or improper conduct toward flags of truce, pillage, unnecessary violence, and destruction of property, etc.

704. The determination of the status of captured troops is to be left to courts organized for the purpose. Summary executions are no longer contemplated under the laws of war. The officers' duty is to hold the persons of those captured, and leave the question of their being regulars, irregulars, deserters, etc., to the determination of competent authority.

CONDUCT OF HOSTILITIES.

705. On general principles it is permissible to destroy your enemy and it is immaterial how this is accomplished. But in practice the means employed are definitely restricted by inter-

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national declarations and conventions and by the laws and usages of war. Generally speaking, the means to be employed include both force and stratagem, and there is included therein the killing and disabling the enemy, forcing him by defeat and exhaustion to surrender, the investment, bombardment, or siege of his fortresses and defended places, the damage, destruction, and appropriation of property, and injury to the general resources of the country.

706. The law of war not only disclaims all cruelty and bad faith concerning engagements concluded with the enemy during the war, but also the breaking of treaty obligations entered into by belligerents in time of peace and avowedly intended to remain in force in case of war between the contracting powers. It disclaims all extortion and other transactions for individual gain; all acts of private revenge or connivance at such acts.

707. The ruses of war are, however, legitimate so long as they do not involve treachery or perfidy on the part of the belligerent resorting to them and do not contravene any generally accepted rule.

708. Among legitimate ruses may be counted surprises; ambushes; feigning attacks, retreats, or flights; simulating quiet and inactivity; giving large outposts or a strong advanced guard to a small force; constructing works, bridges, etc., which it is not intended to use; transmitting false or misleading signals and telegraph messages, and sending false dispatches and newspapers, with a view to their being intercepted by the enemy; lighting camp fires where there are no troops; making use of the enemy's signals, bugle and trumpet calls, watchwords, and words of command; pretending to communicate with troops or reenforcements which have no existence; moving landmarks; putting up dummy guns or laying dummy mines; removing badges

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from uniforms; clothing the men of a single unit in the uniform of several different units so that prisoners and dead may give the idea of a large force.

INTERCOURSE BETWEEN BELLIGERENTS.

709. All intercourse between the territories occupied by belligerent armies, whether by traffic, by letter, by travel, or in any other way, ceases. This is the general rule to be observed without special proclamation.

710. The white flag, when used by troops, indicates a desire to communicate with the enemy. It has no other signification in international law. If hoisted in action by individual soldiers or a small party, it has come to signify surrender. It is essential, therefore, to determine whether the flag was actually hoisted by authority of the commander.

711. The enemy is not required to cease firing when a white flag is raised. To indicate that the hoisting is authorized, the belligerent should cease firing. He should also send a parlementaire.

PASSPORTS, SAFE-CONDUCT, ETC.

712. A passport is a written document given to a person or persons by a commander of belligerent forces authorizing him or them to travel unmolested within the district occupied by his troops.

713. A safe-conduct is a document given to an enemy, alien, or other person or persons by a commander of belligerent forces authorizing him or them to go into places which they could not reach without coming into collision with armed forces actively operating against the enemy.

714. Passports and safe-conducts should be specific in all particulars and should mention the length of time during

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which they will be in force or the date when they will expire. They are valid in the district of the commander who grants them only. If the persons for whom they are issued violate their terms the papers should be taken up and such cases investigated.

715. A safeguard is a detachment of soldiers posted or detailed by a commander of troops for the purpose of protecting some person or persons, or a particular village, building, or other property. The term "safeguard" is also used to designate a written order by a commander of belligerent forces for the protection of an enemy subject or enemy property. It is usually directed to the succeeding commander requesting the grant of protection to such individuals or property.

716. Soldiers on duty as safeguards are guaranteed against the application of the laws of war, and it is customary to send them back to their army when the locality is occupied by the enemy, together with their baggage and arms, as soon as military exigencies permit.

717. Licenses to trade may be issued under proper restrictions and may be general or special. The commanding officer is the only one authorized to issue licenses to trade. He may delegate this authority to his subordinates.

MILITARY AUTHORITY OVER OCCUPIED HOSTILE TERRITORY.

718. The United States acknowledge and protect, in hostile countries occupied by them, religion and morality; the persons of inhabitants, especially those of women; and the sacredness of domestic relations.

719. In return for such considerate treatment, it is the duty of the inhabitants to carry on their ordinary peaceful pursuits, to behave in an absolutely peaceful manner, to take no part

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whatever in the hostilities carried on, to refrain from all injurious acts toward the troops or in respect to their operations, and to render strict obedience to the officials of the occupant.

720. Services of the inhabitants of occupied territory may be requisitioned for the needs of the Army. These will include the services of professional men and tradesmen, such as surgeons, carpenters, butchers, bakers, etc., employees of gas, electric light, and water works, and of other public utilities, and of sanitary boards in connection with their ordinary vocations. The prohibition against forcing the inhabitants to take part in the operations of war against their own country precludes requisitioning their services upon works directly promoting the ends of the war, such as construction of forts, fortifications, and entrenchments; but there is no objection to their being employed voluntarily, for pay, on this class of work, except the military reason of preventing information concerning such work from falling into the hands of the enemy.

TREATMENT OF ENEMY PROPERTY.

721. In war a belligerent can destroy or seize all property of whatever nature, public or private, hostile or neutral, unless such property is specifically protected by some definite law of war, provided such destruction or seizure is imperatively demanded by the necessities of war.

722. The measure of permissible devastation is found in the strict necessities of war. As an end in itself, as a separate measure of war, devastation is not sanctioned by the law of war. There must be some reasonably close connection between the destruction of property and the overcoming of the enemy's army. Thus the rule requiring respect for private property is not violated through damage resulting from operations, move-

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ments, or combats of the army; that is, real estate may be utilized for marches, camp sites, construction of trenches, etc. Buildings may be used for shelter for troops, the sick and wounded, for animals, for reconnaissance, cover, defense, etc. Fences, woods, crops, buildings, etc., may be demolished, cut down, and removed to clear a field of fire, to construct bridges, to furnish fuel if imperatively needed for the army.

723. The rule of respect for private property, etc., does not interfere with the right of the victorious invader to tax the people or their property, to levy forced loans, to billet soldiers, or to appropriate property, especially houses, boats or ships, lands, and churches, for temporary and military use.

724. All captures and booty belong primarily to the Government of the captor.

Prize money, whether on land or sea, can now only be claimed under local law.

725. Neither officers nor soldiers are allowed to make use of their position or power in the hostile country for private gain, not even for commercial transactions otherwise legitimate.

726. Private property can be seized only by way of military necessity for the support or other benefit of the Army or of the occupant. All destruction of property not commanded by the authorized officer, all pillage or sacking, even after taking a town or place by assault, are prohibited under the penalty of death, or such other severe punishment as may seem adequate. A soldier, officer, or private in the act of committing such violence, and disobeying a superior ordering him to abstain from it, may be lawfully killed on the spot by such superior.

REQUISITIONS.

727. Practically everything may be requisitioned that is necessary for the maintenance of the Army and not of direct

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military use, such as fuel and food supplies, clothing, wine, tobacco, printing presses, type, etc., leather, cloth, etc. Billeting of troops for quarters and subsistence is also authorized.

728. Requisitions must be made under the authority of the commander in the locality. No prescribed method is fixed, but, if practicable, requisitions should be accomplished through the local authorities by systematic collection in bulk. They may be made direct by detachments if local authorities fail for any reason.

729. The prices of articles requisitioned can and should be fixed by the commander. The prices of commodities on sale may also be regulated and limits placed on the hours and places of trading. All authorities agree that it is good policy to pay cash if possible and to take up receipts as soon as possible.

730. If cash is paid coercion will seldom be necessary. The coercive measures adopted will be limited to the amount and kind necessary to secure the articles requisitioned.

PRISONERS OF WAR.

(Appendix 6, F. S. R.)

731. Prisoners captured are evacuated to the rear as soon as the tactical situation will admit. Commanders of regiments on the firing line collect and send them to brigade headquarters. Brigade commanders send them to division headquarters. It is a tactical question to be decided by the circumstances existing at the time considered as to what troops shall be used by these commanders to escort the prisoners to division headquarters, but in the general case care should be taken not to deplete organizations actually fighting in order to provide guards for this purpose. Such escorts should be as small as is consistent with

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preventing escape, but their strength should not be less than 10 per cent of that of the prisoners to be guarded.

732. The examination of prisoners for the purpose of obtaining information is usually a function of the intelligence section of the General Staff. This does not prohibit patrol leaders and the commanders of independent or semi-independent detachments from getting all possible information at once on the spot from such prisoners as may fall into their hands. Such examinations, however, should be conducted in accordance with the rules for obtaining information from prisoners, with which officers and patrol leaders should familiarize themselves.

733. Officers are separated from the enlisted men and when practicable the noncommissioned officers are separated from the privates. Prisoners that have been examined are not allowed to mingle with the others.

734. When necessary to enforce obedience, prisoners who give trouble will be severely handled. All conversation with prisoners, unless an officer is present, except such as the guard may find necessary in feeding and handling them, is forbidden.

735. Prisoners will be searched as soon as practicable after capture, in the presence of an officer. All weapons, ammunition, and documents must be taken from them. They may be allowed to keep their personal belongings and a small amount of money. Receipts are given for money and trinkets taken. They are not allowed to smoke.

736. It is the duty of all commanders to see that escorts return to their proper organizations as soon as they have turned over their prisoners to proper authority and it is the duty of the military police to receive such prisoners promptly whenever practicable to do so. The utmost precautions should be taken by all concerned to prevent escapes.

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737. Wounded prisoners are prisoners of war. In accordance with the provisions of the Geneva convention of 1906, they are entitled to all possible consideration, but nevertheless due precaution must be taken that those physically able to do so do not escape. (R. L. W., 1914.)

SICK, WOUNDED, AND DEAD.

(Geneva convention, 1906, R. L. W., 1914; pars. 329 to 353, F. S. R.)

738. Officers, soldiers, and other persons officially attached to armies, who are sick or wounded, shall be respected and cared for, without distinction of nationality, by the belligerent in whose power they are.

739. A belligerent, when compelled to leave his wounded in the hands of his adversary, shall leave with them, so far as military conditions permit, a portion of the personnel and matériel of his sanitary service to assist in caring for them.

740. As soon as possible each belligerent shall forward to the authorities of their country or army the marks or military papers of identification found upon the bodies of the dead, together with a list of names of the sick and wounded taken in charge by him.

741. Military authority may make an appeal to the charitable zeal of the inhabitants to receive and, under its supervision, to care for the sick and wounded of the armies, granting to persons responding to such appeals special protection and certain immunities.

742. Mobile sanitary formations (i. e., those which are intended to accompany armies in the field) and the fixed establishments belonging to the sanitary service shall be protected and respected by belligerents.

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743. The personnel charged exclusively with the removal, transportation, and treatment of the sick and wounded, as well as with the administration of sanitary formations and establishments, and the chaplains attached to armies, shall be respected and protected under all circumstances. If they fall into the hands of the enemy they shall not be considered as prisoners of war.

744. Buildings and matériel pertaining to fixed establishments shall remain subject to the laws of war, but can not be diverted from their use so long as they are necessary for the sick and wounded. Commanders of troops engaged in operations, however, may use them in case of important military necessity if, before such use, the sick and wounded who are in them have been provided for.

745. The general principle to be observed is that all sick and wounded who are not likely to be available soon for duty shall be promptly evacuated to the rear, and not remain as a burden on the limited transportation and sanitary facilities at the front.

746. In case of doubt as to what to do with a sick or wounded man, consult the nearest medical officer.

747. Commanders must see that their men are instructed in prophylactic measures against venereal diseases.

748. Should it become necessary to abandon our own sick or wounded, they should be made as comfortable as possible in any substantial buildings that may be available. If circumstances warrant it, medical personnel sufficient to care for them should be left with them. If in friendly country, they should be turned over to the civil authorities, provided that there are facilities for taking care of them. In hostile country, a request should be made to the officials of the municipality where

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the men are left that they be cared for. In cases where the sick and wounded are abandoned through stress of battle, the arrangements that may be made for their care are necessarily limited and incomplete.

749. During a battle in open warfare, the medical personnel of the regiments engaged assemble the wounded, as fast as circumstances will admit, at the regimental aid stations. From these points the medical personnel of the ambulance companies move them back to dressing stations. In case of early success, these stations may be changed into field hospitals, but the usual method of procedure is to establish field hospitals farther to the rear and to move the wounded from the dressing stations to these. Stations for slightly wounded are also established on important roads leading to the rear.

750. As soon as possible after victory is assured the battle field is policed. The division surgeon, under the orders of the division commander, has a thorough search made for both friendly and hostile wounded, and sees that all are cared for. If the tactical situation admits of it, local commanders will have anticipated him in this; but it must be thoroughly understood by all commanders that members of the combatant force must not allow humane ideas to cause them to desist, in the slightest degree, from the paramount duty of clinching the victory and taking up the pursuit. Nor must men be allowed to leave their places during the battle to attend to the wounded unless they receive specific orders in each case from proper authority to do so.

751. The division surgeon, having received sufficient information from the division commander and from the reports of the medical personnel to estimate the amount of work to be done, calls for the necessary details to care for all of the wounded,

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both friend and foe. Regimental bands should be utilized for this work, but if necessary additional detachments are asked for.

752. Details of enlisted men, under line officers, collect and bury the dead, in accordance with orders from division headquarters. Careful lists of these are made, giving as complete information as it is possible to collect under the circumstances. The identification tag is usually buried with the body. If there is no tag, and the man can be identified by papers on his person or other means, a bottle containing a piece of paper with his name and regiment should be buried with him. Careful records should likewise be made of the hostile dead.

753. In trench warfare these regulations must generally be modified. It is often impracticable to get the wounded back promptly; sometimes not at all. In moving the wounded to the rear full use should be made of the communicating and other trenches to gain protection. Every effort should be made to relieve our own wounded and get them to the rear, as their presence is likely to have a bad moral effect on the men left at the front. Under cover of darkness much that could not be thought of in daylight may be done. If practicable, the dead should be buried well to the rear. If this can not be done, then they should be put out of sight in the daytime and buried at night.

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CHAPTER IX.

FIELD MANEUVERS.

GENERAL PRINCIPLES.

754. Field maneuvers *complete* the course of instruction begun with garrison drills and continued in minor field exercises. They simulate the conditions of war and acquaint troops with the possibilities and difficulties of actual campaign. They afford almost the only opportunity in peace for the exercise of the functions of the higher commanders in the field, and furnish officers of all grades, and enlisted men as well, opportunities to study the military operations of the arms combined. In maneuvers alone can the importance of time, space, and weather conditions be fully realized, and a satisfactory knowledge gained of the labor attending the movement, transportation, and supply of troops.

755. To secure the maximum benefit from maneuvers, troops should be familiar not only with the usual extended order drill and battle exercises but with the elementary principles and practice of security and information, and the ordinary duties required of officers and men in the field. This knowledge is gained in exercises at their stations, on practice marches, and during the annual target practice.

756. When practicable, maneuvers in warm climates are held in September or later. At this season troops suffer less from heat, the greater part of the crops is harvested, less damage results, and the country is more open.

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757. The region selected for maneuvers should fulfill the following conditions:

It should be large enough to permit the troops to operate as in war.

Its location should be central with reference to the stations of participating troops.

It should be readily accessible by railroad or water transportation, and there should be good wagon roads to the proposed camp sites.

The terrain should be diversified, most of it practicable for troops of all arms, and with large open spaces for camps, etc. Undulating grazing country with scattered woods is most suitable.

It should be naturally free from contagious diseases and have an ample supply of pure water.

758. For the general use of officers, maps of maneuver grounds are prepared on a scale of 3 inches to 1 mile, with 20-foot contours. In addition, for the preparation of problems and for the use of the higher commanders, guide maps of the maneuver ground and surrounding country, about 1 inch to the mile, are necessary. These can generally be obtained from the United States Geological Survey. For the chief umpire and for use at the discussions, one or two detailed maps, 12 inches to the mile, are prepared on canvas or heavy paper. Reproductions of the 3-inch map, reduced to a scale of 1 inch to the mile, are prepared for general distribution to the troops.

759. During maneuvers and other field exercises, the commander from time to time may require the troops to take the field and live as in actual campaign.

760. The opposing forces are designated *Blue* and *Red*. All troops at maneuvers wear the prescribed field service uniform,

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except that in the Red forces a broad red band is worn around the hat.[1]

The headquarters of the opposing forces are marked by blue and red banners, respectively. Headquarters of organizations may be marked, according to the force to which they belong, by blue or red flags or pennants with appropriate insignia. In maneuver combats the national, regimental, or battalion colors or standards are not carried.

When desirable the troops may be located in two camps some miles apart.

PROGRAM OF INSTRUCTION.

761. The program of instruction, showing in general terms the daily work contemplated, is distributed to the troops upon arrival. When the troops have not had suitable preliminary preparation, the program includes instruction by practical demonstrations, regimental and brigade drills, exercises in security and information, deployments, small maneuvers, etc. These minor maneuvers should be progressive, beginning with the company and ending with all arms combined. If practicable, there should also be a review of the entire command.

Instruction is also imparted by lectures and conferences.

762. Under the direction of the commander of maneuvers the *problems* are prepared as outlined in the program of instruction. These problems are framed under the assumption of a state of war involving hostile operations, and are usually expressed in *general* and *special situations*.

The general situation is given to both parties and contains the information supposed to be generally known. A special situa-

[1] Outside of the insignia, difference in headgear is about all that distinguishes modern armies in the field.

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tion is given to each commander and contains full information in regard to his own command and such information of the enemy as might have been obtained in actual warfare.

Simple situations generally admit of a number of solutions and are more useful than those based upon numerous and remote suppositions. Unnatural assumptions are avoided.

With large opposing forces the same general situation may serve for several days, or even for the whole maneuver period; with smaller commands changes are usually necessary. Unreal conditions, permitting a force to discover the actual strength and location of its adversary through means which could not be employed in war, are avoided.

The technical work of engineer, signal, and sanitary troops is carried out as far as practicable. First-aid and dressing stations are established, and field hospitals set up as in war.

Combat, field, and supply trains are represented by all the wagons available.

UMPIRES.

763. The commander of maneuvers, when not performing the duties of *chief umpire*, is assisted by an officer bearing that title. This officer has charge of the details of the preparation and conduct of the problems, and is assisted during the exercises by additional umpires, sufficient in number to secure proper control.

Umpires are selected from grades above that of first lieutenant. They are staff officers of the commander of maneuvers, and their orders, signals, and decisions are considered as emanating from him. They are therefore promptly obeyed without question. That they may be readily recognized, they wear a broad white band around the hat. Their orderlies or messengers wear a broad white band on the left arm above the elbow.

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Though umpires may accompany particular units, they are not ordinarily assigned thereto, but are distributed by the chief umpire so as to cover all ground involved in the exercise. Knowing the plans of the commanders, umpires can be at points of contact, or where decisions will probably be required, at the proper time.

764. So far as possible, umpires furnish commanders the information derived in war from the actual flight of the bullets and projectiles themselves; for instance, that the troops are under fire of a certain kind and volume. With this information the commanders decide upon their own line of action, namely, to deploy, advance, seek cover, fall back, open fire, etc. Umpires, however, are careful to give no information that troops could not obtain in actual warfare. At important epochs during a maneuver, umpires note on their maps the positions of the troops under their observation.

When a commander receives information from an umpire which, in the opinion of the latter, should cause a change of formation, position, or action of the troops, and the commander does not voluntarily make a change, the umpire renders a decision. The decision causes the troops to do what the umpire thinks they actually would do in war under the circumstances.

The *work of umpires* is intended to supply, as far as practicable, the impressions and effects of actual war. Their decisions take the place of bullets and other projectiles, and prevent unnatural or impossible situations. As a rule, maneuver exercises tend to develop too rapidly. This tendency is counteracted by the decisions which produce the delays incident to war. In this manner exercises are logically developed and the creation of false impressions is prevented.

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In addition, umpires note the leadership and conduct of troops, and thereby enable the chief umpire to call attention to the same at the subsequent discussion and in his final report.

Umpires give prompt and definite decisions and see that they are carried out. When several umpires meet, the senior announces the decision. If an umpire concludes from further information that he has made an erroneous decision, he so reports to the chief umpire at the earliest practicable moment.

The orders of an umpire to troops are given, when practicable, through their commander.

The chief umpire usually assembles the umpires on the afternoon or evening preceding an exercise, furnishes them copies of the problem, and gives the necessary instructions. At the close of an exercise he may assemble them to compare data, receive criticisms, and decide disputed points, or he may require them to submit written reports of their observations and actions.

In maneuvers of considerable magnitude the position of the chief umpire is usually indicated by a white flag with a diagonal red cross.

765. When practicable, signals to troops and umpires are communicated by means of a balloon. Notices to commence, suspended, or cease operations, etc., may be given by the use of bombs or rockets; in the absence of other means the trumpet is used.

When the chief umpire makes use of the trumpet the signal ATTENTION is sounded by his order only, and is used as follows:

"Attention, cease firing, attention"—all firing ceases and all troops halt in their places.

"Attention, commence firing, attention"—operations are resumed.

"Attention, recall, attention"—troops return to their respective camps or bivouacs.

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Officers commanding troops cause the chief umpire's calls to be repeated, but no trumpeter repeats these calls without an order from an officer.

To control the exercises in particular localities, umpires may make use of whistle signals. Such signals are obeyed by the troops in hearing, but are not repeated in other parts of the field.

766. At the close of an exercise the chief umpire prepares data for the subsequent discussion. At the close of the maneuvers he prepares such report as the commander may require.

DISCUSSIONS.

767. After the conclusion of an exercise in which the whole or a large part of the command has participated the officers concerned are assembled, weather permitting, for the purpose of discussing the tactical and other military features involved. At such discussions the commander of maneuvers, or some officer designated by him, presides. The discussion is opened by the chief umpire, who reads the general and special situations, gives an outline of the exercise as it actually developed, and offers such criticisms and comments as he deems desirable. The commanders of the opposing forces are then called upon to read or state the orders issued by them and to give their reasons therefor. The discussion is then made general.

During the discussion assistant umpires, when called upon by the commander of maneuvers or the chief umpire, describe the movements and action of the troops that came under their observation, but make no criticism in regard thereto.

When the troops are located in *two camps* and it is not practicable, after a combined maneuver, to assemble the officers at one place, a discussion is held in each camp, an umpire being detailed to perform the duties of chief umpire in the latter's

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absence, the camp commander presiding when the commander of maneuvers is not present.

Criticisms must be entirely free from remarks having a personal bearing, individuals being referred to by their official titles and not by name. When errors are pointed out by the chief umpire he indicates the course of action which, in his opinion, would have been proper under the circumstances.

Discussions are regarded as confidential, and no person not on duty with the troops or serving as umpire is allowed to attend unless invited by the commander of maneuvers.

Where, for purposes of instruction, as outlined in par. 817, smaller exercises are held, an officer is assigned as chief umpire of each, and the discussion is held, when practicable, on the ground at the conclusion of the exercise, the officers concerned being assembled for that purpose. The senior officer presides, and the discussion follows the lines indicated above.

EFFECT OF FIRE—UMPIRES' DECISIONS.

768. The effect of fire is influenced by so many considerations that it is impossible to predict the result with accuracy.

There are many factors whose effects can not be computed. However, by practice in calculating losses in hypothetical cases a knowledge of the *principal factors* governing the effect of fire is obtained and a faculty acquired of quickly estimating their influence or effect upon troops. This faculty umpires are supposed to have acquired by previous study and experience. At maneuvers there is no time to make complicated calculations or to consult a table of losses; the umpires, therefore, decide promptly according to their best judgment. Such decisions are ordinarily as follows:

(1) That troops can not continue their march. For instance, when in close order they come under a fire which, in war, would compel a deployment or change of direction.

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(2) That they can not advance for a certain period of time. For instance, when advancing more rapidly than they would in actual warfare.

(3) That they can not advance at all unless reinforced. For instance, when the enemy's fire is so effective that troops would probably not advance against it in actual warfare.

(4) That they must retire to a designated point affording cover. For instance, when they have been surprised and are more or less demoralized, or have been driven from a position, or have failed in an attack.

(5) That they can not take the offensive for a stated period. For instance, when they have just made an unsuccessful attack, suffered heavy losses, or have made an exhausting march at double time.

(6) That they must retire from the field for a stated period. For instance, when a patrol in actual warfare would have been annihilated or captured. Umpires seldom rule whole commands entirely out of action.

The decisions of umpires are based upon the actual strength of the troops engaged.

RULES TO ASSIST UMPIRES.

Small arms.

769. The efficacy of *infantry fire* is influenced by many circumstances, such as distance and form of the target, degree of accuracy in estimating the range, adjustment of sights, fire discipline, physical condition of the soldier, etc.

At ranges from 1,600 to 1,200 yards the well directed and controlled fire of a considerable force is very effective against stationary targets as large as two companies of infantry in close order.

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Under 1,200 yards skirmish lines without cover and under effective fire can not continue the advance unless supported by a fire superior to that of the enemy.

Between 1,200 and 900 yards supports or reserves in close order without cover can advance, make short halts standing, or move by a flank, only when supported by a fire superior to that of the enemy.

Under 900 yards troops without cover, even though preceded by a strong firing line, can move only to the front or rear over fire-swept ground.

Under 600 yards a fire fight without cover must terminate in a short time in an assault or a retreat.

In open country without cover, cavalry mounted should not appear in front of unshaken infantry nearer than 1,200 yards, unless advancing to the attack in proper formation.

Mounted patrols should not be ordered to the rear or out of action on account of being exposed to long-range fire, if they adopt suitable formations and gaits to lessen the chances of being hit.

The result of an infantry charge depends upon the effect of the preceding infantry and artillery fire, the relative strength of the contending forces, nature of the ground, direction and execution of the attack, conduct of the defenders, etc. As the losses would probably be severe, the attackers or defenders are generally ordered to the rear for a stated period.

Enfilading fire, or a well-directed fire at close range delivered as a surprise, is given greatly increased weight.

The fire of dismounted cavalry is considered as effective as that of infantry, but the *strength* of the unit is reduced at least one-fourth on account of the horse holders and guard for the led horses.

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Frontal fire of infantry against artillery provided with shields has little effect, but a battalion of infantry firing at a single battery from a position 30 or more degrees removed from the line of fire of the battery, and at a range not exceeding 1,200 yards, is sufficient to silence the battery.

At a distance of 1,200 yards or less, favorable conditions, such as actual cover, are necessary to enable artillery to limber or unlimber. At less than 1,200 yards it soon loses its mobility. If it accompanies infantry in the advance it suffers corresponding losses.

MACHINE GUNS.

770. The fire of machine guns is affected by the following considerations: The suddenness with which it is opened, the size and density of the target, the correctness of the sighting, and the facilities for observing its effects. The well-directed fire of machine guns is very effective against bodies of troops in close order at ranges under 1,800 yards; it is also effective against skirmishers standing—making a continuous advance impracticable. With good facilities for observation it is effective against skirmishers lying down at ranges up to 1,200 yards, but when the facilities for observation are not good skirmishers lying down do not constitute a favorable target beyond 700 yards.

Machine-gun fire is mechanical infantry fire, of the same range as ordinary infantry fire, but capable in battle of supplying a greater power of resistance and producing a greater ultimate effect.

It has greater moral effect than ordinary infantry fire, because of its nerve-racking rattle and quick action upon exposed targets.

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Machine guns are untrustworthy and comparatively ineffective weapons in the hands of untrained men.

For all ranges less than 600 yards, 1 machine gun=16 men; for ranges from 600 to 1,200 yards, 1 machine gun=22 men; for ranges above 1,200 yards, long and distant, 1 machine gun=39 men.

At targets and ranges when the lateral dispersion of the machine gun is less than the width of the intervals between the elements composing the targets, as would be the case in firing at a skirmish line with intervals, machine-gun fire is much less profitable than infantry.

At targets and ranges when the dispersion of the machine gun covers a number of the elements composing the target, the fire of one machine gun is superior to the fire of the number of rifles it displaces.

In firing at ranges where it is a question of covering certain points or defined areas with a beaten zone as in fire of position, machine-gun fire is greatly superior to infantry fire.

ARTILLERY.

771. In judging the effect of artillery fire, the following circumstances must be considered: Whether the artillery has opened a sudden and effective fire from a concealed position; the number of guns firing upon the same object; the rapidity and duration of the fire; the range; the size and formation of the objective; whether moving or not; and finally, whether the artillery itself is under fire.

A battery opening fire with a knowledge of the range gained from another battery already in action is assumed to begin effective fire with the first shot; otherwise the time for finding the range must be considered. This time varies with the range, the difficulties of observation, and the degree of training of the

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battery, but in ordinary cases, at ranges above 2,000 yards, will not be less than two minutes, reckoned from the first shot.

At a distance of about 3,500 yards artillery which has found the range can make it difficult, and in some cases impossible, for even a superior opposing force of artillery to unlimber. Artillery, unless it is much superior in strength, can rarely produce an effect on opposing artillery at distances over 3,500 yards without the cooperation of other arms.

At ranges less than 3,000 yards a slight superiority will make itself felt. Enfilade fire from artillery is much more effective than frontal fire.

In the face of a well-sustained and properly directed artillery fire at distances of 3,500 yards or less, infantry must deploy and move at a rapid gait. At ranges less than 2,500 yards infantry can move only in line of skirmishers and then only to the front and rear. This rule is modified according to the cover afforded by the ground and the relative size of the forces.

Indirect fire is generally not effective against bodies of cavalry smaller than a squadron and moving at a trot.

ATTACK BY CAVALRY MOUNTED.

772. The rapid course of a cavalry attack renders correct decisions difficult. The umpire should be on hand to observe the advance, the deployment, the execution of the attack, and the strength of the opposing forces.

Mounted cavalry receiving a charge at a halt is declared defeated.

A cavalry force charged while in the act of deployment, or struck in flank, is declared defeated even if numerically somewhat superior.

In the attack on cavalry it is of less importance to pass over long distances rapidly than to deliver the shock with cohesion

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and force. Envelopment of a flank increases the efficacy of the attack.

When two cavalry forces of equal strength and proper formation meet in mounted action, the victory would probably fall to the side bringing up the last formed reserve.

In the combat of cavalry against cavalry the defeated force is required to retire 300 yards before the victor is allowed to pursue. The latter may then assemble his forces or continue the pursuit with the force available, preserving a distance of at least 100 yards. The defeated force continues to retreat before an effective pursuit without assembling, unless support is received. The umpire prevents a long pursuit and may rule the defeated force out of action for a stated period.

Against demoralized or badly shaken infantry, a cavalry attack can dispense with deep formations, and comparatively small bodies may do effective work.

Against unshaken infantry favorable conditions are necessary to give a probability of success; for example, cover while approaching, favorable ground, surprise, attack against a flank or while the infantry is changing formation. The cavalry must be in deep formation and cross the fire-swept zone at a rapid gait. Great losses to the cavalry are to be expected in such attacks.

Artillery in motion is considered helpless against a cavalry attack, unless protected by other troops. Artillery in action is most vulnerable on an unsupported flank. Frontal attack against artillery and machine guns requires favorable ground, skillful handling, and an adequate force; the losses would probably be heavy.

Should the cavalry succeed in reaching the artillery, the result would still depend upon their ability to disable or carry off the pieces, or to secure the victory in some other way.

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CONDUCT OF TACTICAL EXERCICSES.

773. Maps of the maneuver district are issued to troops on or before their arrival at the maneuver grounds.

774. The commander of maneuvers issues the necessary orders to secure compliance with the program of instruction. *Problems are given out in time to enable commanders to estimate the situation and prepare their initial orders.* This time should vary so as to introduce the feature of sudden encounters and compel commanders to render quick decisions.

775. The commanders of the opposing forces are guided by the general and special situations and instructions received by them. They issue orders as in campaign, and furnish the chief umpire, before each exercise, a copy of their initial orders. They also furnish the umpire accompanying them a copy or statement of all orders and instructions subsequently issued by them. Commanders explain their intentions to umpires when requested by the latter.

776. All duties pertaining to the maneuvers are performed, as far as practicable, as they should be in actual war.

The practice of riding far beyond the outposts without escort, to make a preliminary study of the terrain, bears little resemblance to what is done in war, and is forbidden.

777. It is the duty of commanders of units to take cognizance of the fire of their opponents and govern themselves accordingly. It is *especially necessary* to counteract the tendency to disregard long-range artillery and infantry fire, so difficult to appreciate at maneuvers.

778. Intrenchments, gun pits, obstacles, etc., are actually constructed unless peace conditions forbid. Instructions in such matters are given by the commander of maneuvers before an exercise begins.

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When not actually constructed, intrenchments, gun pits, obstacles, and the demolition of bridges, loopholing of walls, etc., are outlined or indicated. The position of intrenchments is indicated by small flags—blue for the Blue army and red for the Red army. The destruction of bridges, etc., is indicated by suitable inscriptions, the time of destruction being stated. When the construction of works or demolitions is assumed, the commander informs the nearest umpire, who decides how much of the work could have been done with the means and in the time available, and causes proper notice to be taken by the opponent. Claims for the construction of works or for demolitions are not allowed unless the necessary tools, material, and troops have actually been available for such work.

779. *Officers under no circumstances dispute with an umpire at the time a decision is given.* Should a decision be deemed erroneous, officers may, after the close of the exercise, make an appeal in writing, setting forth the facts as they appear to them. It must be remembered, however, that the decision of an umpire is rendered in accordance with his best judgment, and though the decision may appear wrong, the outcome in actual combat, due to the element of chance in war, might have been as he decided.

780. During pauses ordered by the commander of maneuvers or the umpires a complete standstill in the operations is required; *messages must not be sent, orders issued, or the position of troops changed.*

781. When important decisions are rendered, commanders at once notify their superiors and the commanders of adjoining troops.

782. In a *combat exercise* the problem is drawn so as to cause the exercise to develop within the limits represented on

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the chief umpire's map. The chief umpire assigns or distributes his assistants as he deems advisable, and causes them to make as careful a study of the ground and map as time permits. One umpire is assigned to accompany each of the supreme commanders. For convenience these two umpires are referred to, respectively, as the senior umpire, Blues, and the senior umpire, Reds.

At the proper time the chief umpire establishes his headquarters at some *central* or convenient point (*central station*) and opens communication with the *senior umpires*. The latter establish communication with their assistants who report the progress of events in their parts of the field. By this means the plans of commanders, location and movements of troops, targets and character of fire, etc., can be forwarded to the central station, and, when necessary, passed on to the opposite side to enable the local umpires to impart proper information to the troops and to render logical decisions.

In extensive maneuvers where signal troops are available, information between the umpires may be transmitted as follows:

A line is established connecting the central station with the senior umpires on each side; communication between the senior umpires and their assistants is maintained by messenger service and by using the signal lines established between the supreme commanders and the principal fractions of their commands (for instance in case of attack, connecting headquarters with the artillery, the main and secondary attacks and with the reserve); the umpires use the nearest signal stations, or send information by messenger. Messengers are used to supplement the wire service. For short distances or where long orders or messages are sent, information is generally carried

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by messenger. For instance, at *urgent* speed and for distances up to about half a mile, a mounted messenger can deliver a message of 10 words in less time than it can be delivered by wire.

If an assistant umpire can send a message more easily to the central station than to his senior umpire, he does so. As the troops approach more closely, assistant umpires may be able to "cross over," or communicate more easily with the opposing side than through the central stations, but important decisions made under such circumstances must be promptly reported to the central station.

At the central station the chief umpire is assisted by a typewriter and three officers, one to keep a record of events, the others to assist in receiving and sending messages, and in following the progress of events on the map, which is done by means of "troop signs."[1] The chief umpire is not necessarily confined to the central station, but goes wherever he deems his presence necessary, the work at the central station being carried on by his assistants.

Due to the fact that umpires are required to use the lines of information established by the opposing forces, *troops are forbidden to cut signal wires* unless authorized to do so by the commander of maneuvers. Umpires, however, make the proper rulings in regard to lines captured or "destroyed." All umpires' messages are confidential.

When signal troops are used, the central station should be provided with two mounted or cyclist orderlies, and each senior and assistant umpire with one mounted orderly. Without signal troops these numbers should be doubled. The central station is also provided with a light wagon for use in case a change of position becomes necessary.

[1] Colored pins, etc.

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By this method of umpiring, troops are informed of the kind, volume and direction of fire to which they are subjected (information acquired in war from the projectiles themselves), their commanders given an opportunity to make the necessary dispositions and the umpire enabled to render intelligent decisions.

783. The supply of ammunition is usually limited, and it often happens that firing ceases because the supply is exhausted. In such cases the troops simulate firing, and the opposing troops are notified through the umpires that firing of a certain character and volume continues. When ammunition is limited the time of actual firing may be prolonged by permitting only a fraction of the troops engaged to fire at a time, for instance, one man in four. In such cases it is assumed that all of the troops concerned are engaged.

784. Unless contrary orders are given by the commander of maneuvers, all troops march fully armed and equipped, except as to ammunition. Blank ammunition only is carried, the number of rounds being regulated in orders.

It is of such great importance, however, to accustom troops to the amount of ammunition used in war, to instruct officers in regulating its expenditure, and to solve practically the problem of ammunition supply, that some, at least, of the tactical exercises should be conducted with the full service allowance of cartridges.

785. Before leaving the camp or bivouac, an inspection is made to ascertain that no ball cartridges are carried. *These inspections are made by officers*, and reports thereof are made to the senior umpires on each side.

All members of a command taking part in, or attending a field exercise, are forbidden to carry on their persons, or horses, or with fieldpieces, caissons, or other means of transportation, fixed ammunition or ball cartridges of any kind whatever. No

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weapons, other than those constituting part of the regulation equipment of officers and men, are carried.

786. The actual collision of opposing forces must be prevented, commanders of units being held responsible. When the combat reaches the stage just preceding the crisis, the commander of maneuvers or the chief umpire gives the signal for suspension of operations, and the relative numbers and positions of the contending forces are carefully noted. The chief umpire or commander of maneuvers then decides whether to continue the exercise or not. If continued one or both of the opposing forces may be required to withdraw to a suitable distance before hostilities are resumed. Local combats are similarly controlled by the local umpires.

787. Firing by opposing parties is discontinued when they arrive within 100 yards of each other, and the umpires then make a decision. Usually a definite decision is reached before the troops come to such close contact.

788. When, as a result of close contact in wooded country, the opposing forces are intermingled or the troops out of hand, it may be advisable for the umpires to order a suspension of operations until the lines are reestablished.

789. Should a force succeed in approaching within 100 yards of another without being discovered, captures may be made by giving the command "Halt, surrender." The umpire considers the strength of the opposing forces, the nature of the ground, and other circumstances, and decides whether actual capture was possible. Captured troops are disposed of in accordance with rule 6, section 16.

790. Commanders of opposing dismounted forces approaching within 100 yards of each other, in the absence of umpires, order firing to cease, halt their men and direct them to hold their

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rifles vertically, butt uppermost, as a signal that the decision of an umpire is awaited. Troops in this situation must not be attacked.

791. Cavalry charges against dismounted troops must be brought to a full stop at 100 yards from the troops attacked. Against mounted troops the charge stops at 50 yards; in the charge as foragers cavalry is permitted to ride up to and through wagon trains and batteries not firing, but no revolver firing is permitted at less than 50 yards.

792. When patrols of equal strength meet, the umpire decides which has the advantage and causes the other to withdraw. If a patrol meets a stronger force, it retires unless the umpire decides that superior leading entitles it to advance, in which case the other force retires to the distance prescribed by the umpire.

793. An individual, mounted or dismounted, when halted and called upon to surrender, or when fired upon, by two or more dismounted men at a distance of 100 yards or less, *gives himself up.* The same rule applies up to 150 yards for an individual fired upon while at a halt and in good view. In the case of moving individuals, mounted or dismounted, at a distance greater than 100 yards, the umpire decides according to the amount of fire and other circumstances.

794. Mounted men who find their retreat cut off by superior numbers of mounted opponents surrender when it is evident that they can not escape without being closely pursued.

795. In all exercises the greatest attention is given to fire discipline. Violation of the rules and a waste of ammunition will be the subject of unfavorable report by the umpires.

796. Exercises are terminated by the proper signal from the commander of maneuvers or the chief umpire. The troops then return to their camps or bivouacs.

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797. At the conclusion of an exercise the commanders of the opposing forces submit such data to the chief umpire as the latter may require for the subsequent discussion and for his final report.

PRIVATE PROPERTY.

798. There must be no firing in the immediate vicinity of houses, barns, haystacks, ricks of fodder, etc. No camps or bivouacs are established in orchards, parks, or fields under cultivation without the owner's consent.

799. Troops at maneuvers confine themselves to the maneuver grounds; they do not enter houses or other buildings, yards, gardens, lawns, tobacco fields, vineyards, nurseries, or orchards in fruit season without the owner's consent. Other fields or grounds from which troops are excluded are marked by white flags. Marching troops not engaged in tactical exercises confine themselves to the public roads.

800. Officers and noncommissioned officers on duty with troops and umpires prevent unnecessary injury to property.

801. Officers and noncommissioned officers are held responsible for wanton damage committed in their presence. Offenders are immediately placed under guard and brought to trial. In all cases of depredation or wanton damage, boards of officers are appointed by the commanding officer to assess damages.

MISCELLANEOUS.

802. The chief surgeon, under the direction of the commander of maneuvers, supervises the hygiene of the maneuver camps. Under his charge daily sanitary inspections are made; if faults are found, the attention of regimental commanders is called to them, and the necessary steps are taken by the latter

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for their correction. Any failure to remedy insanitary conditions is reported to the commander of maneuvers.

All drinking water on the maneuver ground is examined and marked "good" or "bad" before the exercises begin.

803. When necessary a *provost marshal* with a suitable mounted force is detailed to act as police during the exercises. It is the duty of the marshal to see that spectators are directed to points affording good view, and that they do not interfere with the exercise or damage property. Spectators will be requested not to precede the advance guard of either force nor gather in positions liable to mislead the combatants.

804. Military attachés, duly accredited military and naval observers from foreign countries, and from the Organized Militia, and officers of the Regular Army attending the maneuvers in an official capacity, either accompany the commander of maneuvers or are otherwise suitably disposed of. Such persons wear a broad white band on the right arm above the elbow.

805. Military attachés and duly accredited military or naval observers are provided with suitable mounts and orderlies and an officer is detailed to see that they are properly cared for. They are furnished with such shelter, messing facilities, transportation, and information as the commander of maneuvers directs, and are saluted and accorded the honors due their rank.

806. Properly accredited correspondents of newspapers and other publications accompanying United States troops in the field or attending maneuvers are afforded information and other facilities not inconsistent with the success of the operations. Such correspondents wear a red band on the right arm above the elbow.

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APPENDICES.

WEIGHTS, MEASURES, MONEYS, ETC.

1. LINEAR MEASURE.

	Inch.	Foot.	Yard.	Rod.	Chain.	Furlong.
Foot	12	1				
Yard	36	3	1			
Rod, pole, or perch	198	16½				
Chain	792	66	22	4	1	
Furlong	7,920	660	220	40	10	
Mile	63,360	5,280	1,760	320	80	8

2. MISCELLANEOUS MEASURES OF LENGTH.

A fathom = 6 feet.
A cable's length = 1/10 nautical mile = 202.7 yards.
A degree of latitude = 69.16 English miles or 60 nautical miles.
A league = 3 nautical miles.
A nautical mile = 6,080 feet = 2,026⅔ yards.

3. SQUARE MEASURE.

	Square inch.	Square foot.	Square yard.	Square rod.	Acre.
Square foot	144	1			
Square yard	1,296	9	1		
Square rod, pole, or perch	39,204	272¼	30¼	1	
Acre	6,272,640	43,560	4,840	160	1
Square mile			3,097,600	102,400	640

An acre is about 69 yards or 208 feet square. The approximate number of acres in a rectangular tract = 1/70 width in yards × 1/70 the length in yards.

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4. CUBIC MEASURE.

1,728 cubic inches = 1 cubic foot.
27 cubic feet = 1 cubic yard.
40 cubic feet = 1 shipping ton.
100 cubic feet = 1 register ton.
128 cubic feet = 1 cord of wood.

5. LIQUID MEASURE.

	Pint.	Quart.	Gallon.
4 gills	1		
Quart	2	1	
Gallon	8	4	1
Barrel	288	144	36

United States standard gallon = 231 cubic inches.
31½ gallons = 1 barrel (bbl.).
2 barrels = 1 hogshead (hhd.).
Beer gallon = 282 cubic inches.
The imperial gallon of Great Britain = 277.274 cubic inches.

6. DRY MEASURE.

	Pint.	Quart.	Gallon.	Peck.	Bushel.
4 gills	1				
Quart	2	1			
Gallon	8	4	1		
Peck	16	8	2	1	
Bushel	64	32	8	4	1
Chaldron			1,152	144	36

1 bushel = 2,150.42 cubic inches. The chaldron is a varying measure, used chiefly for coal or coke.

7. AVOIRDUPOIS WEIGHT.

27½ grains = 1 drachm = 27.34 grains.
16 drachms = 1 ounce = 437.5 grains.
16 ounces = 1 pound = 7,000 grains.
14 pounds = 1 stone.

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28 pounds=1 quarter (qr.).
4 quarters=1 hundredweight (cwt.)=112 pounds.
20 cwt.=1 ton=2,240 pounds; a long ton. A short ton=2,000 pounds.

8. TROY WEIGHT.

24 grains=1 pennyweight.
20 pennyweights=1 ounce.
12 ounces=1 pound.

9. APOTHECARY'S WEIGHT.

20 grains=1 scruple.
3 scruples=1 drachm (drm.).
8 drachms=1 ounce.

10. APOTHECARY'S FLUID MEASURE.

60 minims (drops)=1 fluid drachm.
8 drachms=1 ounce.
20 ounces=1 pint.
1 tablespoonful holds 1 ounce; 1 dessert spoon, ½ ounce; 1 teaspoon, ¼ ounce.

11. PARTICULAR WEIGHTS.

A barrel of flour=196 pounds.
A quintal of fish=100 pounds.
A barrel of meat=200 pounds.
A barrel of butter=224 pounds.
A barrel of tar=26¼ gallons.
A tub of butter=84 pounds.
A bushel of coal=80 pounds.
A sack of potatoes=168 pounds.
A sack of coal=224 pounds.
A barrel of soft soap=256 pounds.
A cask of rice=6 cwts.=672 pounds.
A bag of rice=about 1½ cwt.=168 pounds.
A chest of tea=about 84 pounds.
A bag of coffee=1¼ to 1½ cwt.=140–168 pounds.

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12. WEIGHT OF COAL, WOOD, ETC.

Anthracite, per cubic yard=2,160 pounds.
Bituminous coal per cubic yard=2,025 pounds.
A cubic foot of fresh water weighs 62½ pounds.
A cubic foot of salt water weighs 63½ pounds.
A cubic foot of pine wood weighs 41 pounds.
A cubic foot of oak wood weighs 59 pounds.
A cubic foot of clay weighs 125 pounds.
A cubic foot of loose earth weighs 95 pounds.
A cubic yard compressed straw weighs about 145 pounds.
A cubic yard straw in stack weighs about 90 pounds.
A cubic yard of grain=about 20 bushels.

METRIC EQUIVALENTS.

13. LINEAR MEASURE.

Millimeter=0.039 inch=0.001 yard.
Centimeter (10 millimeters)=0.3937 inch=0.011 yard.
Decimeter (10 centimeters)=3.937 inches=0.109 yard.
Meter (10 decimeters)=39.37 inches=1.094 yards.
Kilometer (1,000 meters)=39,370.79 inches=1,093.633 yards.

For approximate calculations assume 1 meter=40 inches; 1,600 meters=1 mile; 5 miles=8 kilometers; or 1 kilometer=⅝ mile.

To convert meters to yards add 1/10; to convert yards to meters, subtract 1/11.

14. SQUARE MEASURE.

Centiare=1.196 square yards.
Are (100 square meters)=119.603 square yards=0.025 acre.
Hectare=11,960.33 square yards=2.471 acres.

15. MEASURE OF WEIGHT.

Gram=0.032 ounce avoirdupois=0.002 pound.
Kilogram=35.26 ounces avoirdupois=2.204 pounds.

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16. MEASURE OF CAPACITY.

Liter=1.759 pints=0.22 gallon=aproximately 1 quart.
Hectoliter=175.976 pints=21.997 gallons.

17. CONVERSIONS.

To convert yards to meters multiply by 0.914 or roughly subtract 1/11 of number of yards from yards.
To convert miles to kilometers multiply by 1.609 or roughly multiply number of miles by 8/5.
To convert acres to hectares multiply by 0.405.
To convert pounds avoirdupois to kilograms multiply by 0.454.
To convert gallons to liters multiply by 4.54.

18. MONEYS.

Country.	Monetary unit.	United States equivalent.
Great Britain	Pound[1].	$4.866
France	Franc...	.193
Italy	Lira.....	.193
Russia	Ruble...	.515
Germany	Mark....	.238
Austria	Crown..	.203

[1] 20 shillings=1 pound; 12 pence=1 shilling.

19. CURRENCY (NORMAL VALUES).

FRANCE AND BELGIUM.

1 franc=100 centimes=about 9½ d.; 25 francs=£1.
Coins: 5 centimes,[1] 10 centimes[1]=2 cents (U. S.) 25 centimes (nickel); 50 centimes, 1, 2, and 5 francs (silver), 10 and 20 francs (gold).
The "sou," or halfpenny (=5 centimes), is largely used as a unit in small dealings, e. g., "Quatre sous"=20 centimes; "Dix sous"=half a franc; "Vingt sous"=1 franc; "Piece de cent sous"=5 francs.

[1] Copper in France, nickel in Belgium.

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GERMANY.

1 mark=100 pfennigs=about 1s.; 20 marks=£1.
Coins: 5, 10, 20 pfennigs (nickel)=5 cents (U. S.); 50 pfennigs, 1 mark, 2 and 3 marks (thaler), 5 marks (silver); 10 and 20 marks (gold).

HOLLAND.

1 gulden (florin)=100 cents=1s. 8d.=40 cents (U. S.).
Coins: 5, 10, 25 cents; ½, 1, 2½ florins (silver); 10 florins (ducat)=16s. 8d—(gold).

20. THERMOMETER SCALES.

	Freezing point.	Boiling point.	
Fahrenheit	32°	212°	Used in United Kingdom and Holland.
Centigrade or Celsius	0°	100°	Used in France, Belgium, and Germany.
Reaumur	0°	80°	Used in Germany (occasionally).

Each 5° C.=4° R.=9° F.

For temperature above freezing point:
To convert Centigrade ° into Fahrenheit °, multiply by 9/5 and add 32°.
To convert Reaumur ° into Fahrenheit °, multiply by 9/4 and add 32°.
To convert Fahrenheit ° into Centigrade °, subtract 32° and multiply by 5/9.
To convert Fahrenheit ° into Reaumur °, subtract 32° and multiply by 4/9.

−20° C.=	− 4° F.	20° C.=	68° F.
−15° C.=	+ 5° F.	25° C.=	77° F.
−10° C.=	+14° F.	30° C.=	86° F.
− 5° C.=	+23° F.	35° C.=	95° F.
0° C.=	32° F.	40° C.=	104° F.
5° C.=	41° F.	45° C.=	113° F.
10° C.=	50° F.	50° C.=	122° F.
15° C.=	59° F.		

Normal blood temperature=98½° F.=37° C.

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21. MAGNETIC DECLINATION.

For January, 1917, in the United States; for 1914, in foreign countries. The annual change is given for localities in the United States. The sign (+) denotes that the declination is increasing; the (−) sign that it is decreasing.

City.	Declination.	Annual change.	City and country.	Declination.
	° ′	′		° ′
Montgomery, Ala	2 51 E.	+1	London, England	15 00 W.
Mobile, Ala	4 51 E.	+1	Dublin, Ireland	19 00 W.
Sitka, Alaska	30 25 E.	+1	Quebec, Canada	19 00 W.
Nogales, Ariz	13 39 E.	+4	Winnepeg, Canada	11 00 E.
Little Rock, Ark	7 02 E.	+2	Esquimalt, Canada	25 00 E.
San Francisco, Cal	18 12 E.	+3	Paris, France	13 30 W.
San Diego, Cal	15 30 E.	+3	Bordeaux, France	14 00 W.
Denver, Colo	14 48 E.	+3	Berlin, Germany	8 00 W.
Hartford, Conn	11 50 W.	+6	Brussels, Belgium	13 00 W.
Washington, D. C	5 55 W.	+4	Genoa, Italy	10 00 W.
Key West, Fla	2 30 E.	0	Athens, Greece	4 30 W.
Atlanta, Ga	1 35 E.	−1	Cairo, Egypt	2 30 W.
Chicago, Ill	3 34 E.	−1	Cape Town, South Africa.	27 30 W.
Des Moines, Iowa	8 04 E.	+1		
Topeka, Kans	9 34 E.	+2	Kingston, Jamaica	1 30 E.
Louisville, Ky	1 02 E.	−1	Calcutta, India	1 00 E.
New Orleans, La	5 47 E.	+2	Sydney, Australia	9 30 E.
Portland, Me	16 01 W.	+6		
Boston, Mass	14 02 W.	+6		
Detroit, Mich	1 58 W.	+3		
St. Paul, Minn	8 42 E.	0		
St. Louis, Mo	5 07 E.	0		
Helena, Mont	20 18 E.	+3		
New York, N. Y	10 05 W.	+5		
Albany, N. Y	12 15 W.	+6		
Buffalo, N. Y	7 08 W.	+4		
Columbus, Ohio	1 29 W.	+3		
Guthrie, Okla	10 03 E.	+2		
Portland, Oreg	23 33 E.	+3		
Harrisburg, Pa	7 33 W.	+5		
Charleston, S. C	1 15 W.	+2		
San Antonio, Tex	9 34 E.	+3		
El Paso, Tex	12 49 E.	+4		
Olympia, Wash	23 32 E.	+3		
Cheyenne, Wyo	15 22 E.	+3		

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22. INSIGNIA OF RANK.

	United States.	British.	French.	Belgian.	German.
	Shoulder loop or shirt collar.	Shoulder loop.	Cuff.	Collar.	Shoulder loop.
General	Coat of arms of United States and 2 silver stars.				Gold and silver twist, 2 stars.
Lieutenant general	3 silver stars, 1 large and 2 small.		3 stars[1]	2 vertical gold lace stripes, 3 gold stars, gold thunderbolt.	Gold and silver twist, 1 star.
Major general	2 silver stars	Cross, sword and baton, with star above.	do.[1]	2 vertical gold lace stripes, 2 gold stars, gold thunderbolt.	Gold and silver twist, without star.
Brigadier general	1 silver star	Cross, sword and baton.	2 stars		
Colonel	Silver spread eagle.	Crown and 2 stars.	5 bars,[2] gold or silver.	1 vertical gold lace stripe, 3 gold stars.	Silver twist, 2 stars.
Lieutenant colonel	Silver leaf	Crown and 1 star.	5 bars[3]	1 vertical gold lace stripe, 2 gold stars.	Silver twist, 1 star.
Major	Gold leaf	Crown	4 bars, gold or silver.	1 vertical gold lace stripe, 1 gold star.	Silver twist, no stars.
Captain	2 silver bars	3 stars	3 bars, gold or silver.	3 gold stars	Straight silver cord, 2 stars.
First lieutenant	1 silver bar	2 stars	2 bars, gold or silver.	2 gold stars	Straight silver cord, 1 star.
Second lieutenant		1 star	1 bar, gold or silver.	1 gold star	Straight silver cord, no star.
Warrant officer		Crown on right forearm.	1 silver bar, red striped.	1 silver star on collar.	

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Sergeant major....	(Regimental) chevron [4] of 3 stripes, with arc of 3 stripes.	(Staff) crown and 4 stripes, right upper arm.	2 broad bars, gold or silver.	2 rings of narrow dark brown braiding around cuff and 2 stripes of same material above elbow.	
First sergeant.....	Chevron of 3 stripes, with lozenge.	Crown and 3 stripes, right upper arm.	Double gold or silver stripe.	2 rings of narrow dark brown braiding around cuff.	Gold collar lace with button on it.
Quartermaster sergeant (company).	Chevron of 3 stripes, tie of 1 stripe.	4 stripes, right forearm.	.....	1 ring of narrow dark brown braiding around cuff and 1 stripe of same material above elbow.	
Sergeant.....	Chevron of 3 stripes.	3 stripes, right upper arm.	Single gold or silver bar.	1 ring or stripe of narrow dark brown braiding on arm below elbow.	Collar lace with button on it.
Corporal.....	Chevron of 2 stripes.	2 stripes, right upper arm.	2 dark-blue woolen bars.	1 ring or stripe of broad dark brown or white braid on arm below elbow.	Collar lace.
Lance corporal.....	Chevron of 1 stripe.	1 stripe, right upper arm.	1 dark-blue woolen bar.	.....	Button on plain collar.

[1] When a major general commands a corps or an army, he adds a silver strips above the gold leaves on his cap. He is not a lieutenant general. The next real grade above major general is marshal of France, who has 7 stars.

[2] Silver for cavalry and chasseurs à pied. Bars are about 2 inches long; horizontal for officers, oblique for others.

[3] Three in gold and two in silver, alternating.

[4] Chevrons worn on both upper arms.

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23. TIME DIFFERENCE.

Twelve o'clock noon standard (eastern)[1] time in the United States, as compared with the clocks in the following cities:

Aden	8. 00 p. m.	Lima	12. 00 noon.
Alexandria	7. 00 p. m.	Lisbon	4. 24 p. m.
Amsterdam	5. 20 p. m.	Liverpool	5. 00 p. m.
Athens	7. 00 p. m.	London	5. 00 p. m.
Berlin	6. 00 p. m.	Madrid	5. 00 p. m.
Berne	6. 00 p. m.	Manila	[2] 1. 00 a. m.
Bogota	13. 03 p. m.	Melbourne	[2] 3. 00 a. m.
Bombay	10. 30 p. m.	Mexico City	10. 24 a. m.
Bremen	6. 00 p. m.	Natal	7. 00 p. m.
Brussels	5. 00 p. m.	Paris	5. 00 p. m.
Constantinople	7. 00 p. m.	Petrograd	7. 01 p. m.
Copenhagen	6. 00 p. m.	Rio de Janeiro	2. 00 p. m.
Dublin	4. 35 p. m.	Rome	6. 00 p. m.
Hamburg	6. 00 p. m.	Santiago (Chile)	12. 00 noon.
Havana	11. 31 a. m.	Sitka, Alaska	8. 00 a. m.
Havre	5. 00 p. m.	Stockholm	6. 00 p. m.
Hongkong	[2] 1. 00 a. m.	Vienna	6. 00 p. m.
Honolulu	6. 30 a. m.	Yokohama	[2] 2. 00 a. m.

[1] Eastern time includes: New York, Boston, Philadelphia, Baltimore, Washington, Richmond, Norfolk, Charleston, Buffalo, Pittsburgh, Montreal, Quebec, Ottawa, Toronto, etc.

Central time, which is an hour slower than eastern time, includes: Cleveland, Chicago, St. Louis, Minneapolis, St. Paul, Milwaukee, Kansas City, Omaha, Indianapolis, Cincinnati, Detroit, New Orleans, Memphis, Savannah, Pensacola, Winnipeg, etc.

Mountain time, which is 2 hours slower than eastern time, includes: Denver, Leadville, Colorado Springs, Helena, Regina (N. W. T.), etc.

Pacific time, which is 3 hours slower than eastern time, includes: San Francisco, Portland (Oreg.), Victoria, Vancouver, Tacoma, Seattle, etc.

[2] The time noted is of the following day.

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24. FULL MOON.

Approximate dates of full moon (for new moon add 15 days):

Month.	1917	1918	1919
January	8	27	15
February	6	25	14
March	8	27	15
April	7	26	14
May	6	25	13
June	5	24	12
July	4	23	11
August	3	22	10
September	30	20	8
October	30	19	7
November	28	18	6
December	28	17	5

The moon rises about 50 minutes later, night by night.

102131°—17——25

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